FINAL

ENVIRONMENTAL ASSESSMENT

FOR

EXEMPTED FISHING PERMITS

TO CONDUCT SCIENTIFIC RESEARCH EXPERIMENTS USING PELAGIC LONGLINE GEAR IN THE GULF OF MEXICO (GOM), FLORIDA EAST COAST (FEC), SOUTH ATLANTIC BIGHT (SAB), MID-ATLANTIC BIGHT (MAB), AND NORTHEAST COASTAL (NEC) STATISTICAL AREAS OF THE ATLANTIC OCEAN

March 2005

United States Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Sustainable Fisheries
Highly Migratory Species Management Division
1315 East-West Highway
Silver Spring, Maryland 20910

Exempted Fishing Permits To Conduct Scientific Research Experiments Using Pelagic Longline Gear In The Gulf Of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), And Northeast Coastal (NEC) Statistical Areas Of The Atlantic Ocean

Final Actions:	Consistent with the Magnuson-Stevens Fishery Conservation and Management Act, Atlantic Tunas Convention Act (ATCA), and all other applicable law, authorize scientific research to determine whether gear modifications and/or various fishing techniques can be found to avoid/reduce bycatch and associated regulatory discards of juvenile highly migratory species (HMS) in the GOM, FEC, SAB, MAB, and NEC statistical areas of the Atlantic Ocean, while allowing for the targeted catches of allowable species.
Type of Statement:	Environmental Assessment
Lead Agency:	National Marine Fisheries Service, Office of Sustainable Fisheries
For Further Information:	Heather Stirratt Highly Migratory Species Management Division: F/SF1 1315 East-West Highway Silver Spring, MD 20910 Phone: (301) 713-2347 Fax: (301) 713-1917
Abstract:	Under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the United States may authorize activities otherwise prohibited by the regulations contained in Title 50, Part 635 of the Code of Federal Regulations for the conduct of scientific research and the investigation of bycatch. This Environmental Assessment (EA) analyzes the impacts associated with exempting six pelagic longline vessels from existing area closures and other requirements for the purposes of determining whether gear modifications and/or various fishing techniques can be found to avoid/reduce bycatch and associated regulatory discards of juvenile highly migratory species (HMS) and other non-target species in the GOM, FEC, SAB, MAB, and NEC statistical areas of the Atlantic Ocean, while allowing for the targeted catches of allowable species.

FINDING OF NO SIGNIFICANT ENVIRONMENTAL IMPACT

The Highly Migratory Species (HMS) Management Division of the Office of Sustainable Fisheries submits the attached Environmental Assessment (EA) for the approval of three exempted fishing permits (EFPs) to conduct scientific research experiments using pelagic longline gear in the Gulf of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean for Secretarial review under the procedures of the Magnuson-Stevens Fishery Conservation and Management Act. Copies of the EA are available from NMFS at the following address:

Heather Stirratt
Highly Migratory Species Management Division, F/SF1
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910
(301) 713-2347

The exempted fishing permits will:

- Allow for the use of pelagic longline fishing gear in the June MAB/NEC, FEC/SAB, and DeSoto Canyon closed areas for research; and
- Allow for the retention of undersized swordfish that cannot be returned to the sea alive for scientific sampling and controlled donation to a food-bank;

The EFPs are necessary to support a Cooperative Research Proposal submitted by the Fisheries Research Institute in partnership with the NMFS Southeast Fisheries Science Center, College of William and Mary, Virginia Institute of Marine Science, School of Marine Science, and the University of California, Santa Cruz Long Marine Lab.

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at **40 C.F.R. 1508.27** state that the significance of an action should be analyzed both in terms of context and intensity. Each criterion listed below is relevant to making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

(*1*) *Can the action be reasonably expected to jeopardize the sustainability of any target species that may be affected by the action?*

Approval of these exempted fishing permits would not jeopardize the sustainability of any target species, because such catches are expected to be few in number and will be counted against the appropriate quotas. The exempted fishing permits would allow six domestic fishing vessels the opportunity to conduct bycatch research consistent with conservation and management objectives of the MSA, ATCA, and other applicable law and will not jeopardize the sustainability of target species. By reducing bycatch and regulatory discards, the action may enhance the sustainability of target species.

(2) Can the action be reasonably expected to jeopardize the sustainability of any non-target species?

The action is not expected to jeopardize the sustainability of any non-target species, because such catches are expected to be few in number and will be counted against the appropriate quotas. The approval of these exempted fishing permits may enhance the sustainability of non-target species by reducing/avoiding bycatch and decreasing post release mortality of those non-target species, which are encountered during normal fishing operations.

(3) Can the action be reasonably expected to allow substantial damage to the ocean and coastal habitats and/or essential fish habitat (EFH) as defined under the Magnuson-Stevens Act and identified in FMPs?

The action primarily affects domestic fishing vessels, which would otherwise be fishing in open areas within U.S. waters. Thus, there is no increased danger of damaging U.S. ocean and coastal habitats or EFH. Additionally, the action would not impact entities in the National Register of Historic Places or cause destruction to significant scientific, cultural, or historic resources.

(4) Can the action be reasonably expected to have a substantial adverse impact on public health or safety?

The measures implemented by this rule would primarily impact domestic fishing vessels, which would otherwise be fishing in open areas of the Atlantic Ocean. This action is not expected to have substantial adverse impacts on U.S. public health and safety.

(5) Can the action be reasonably expected to have an adverse impact on endangered or threatened species, marine mammals, or critical habitat of these species?

This action will not significantly harm or increase fishery interactions with endangered species or their habitat. There is no increase in fishing effort associated with this activity and participating vessels would be fishing regardless of their participation in this planned research activity. Incidental takes of, or interactions with, protected species that are listed as threatened or endangered under the Endangered Species Act taking place under the auspices of an exempted fishing permit would be included against the authorized incidental take levels specified in relevant BiOps. Most recently, NMFS issued a BiOp for the pelagic longline fishery in June 2004.

(6) *Can the action be reasonably expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?*

The action is not expected to result in cumulative adverse effects that could have a substantial effect on target or non-target species. As stated in Section 4.0, the catch level of target and non-target species will not be significantly impacted by this action.

(7) *Can the action be reasonably expected to have a substantial impact on biodiversity and ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?*

The action is not expected to have a substantial impact on biodiversity and ecosystem function because it will not increase fishing effort. Section 4.0 discusses the impacts of all the measures and examines their expected impacts.

(8) *Are significant social or economic impacts interrelated with significant natural or physical environmental effects?*

NMFS has conducted an economic analysis of the proposed scientific research. The results of these analyses indicate that the economic impacts of these actions would be minimal. The exempted fishing permits would allow six domestic fishing vessels the opportunity to conduct bycatch research in areas that would otherwise be closed to pelagic longline vessels for the purposes of fishing. The fishermen committed to this research have agreed to accept per-set compensation levels consistent with the approved Cooperative Research Grant Proposal submitted by the applicant (Fisheries Research Institute) to the NMFS. In order to offset economic impacts, participating vessels in the DeSoto Canyon closed area would also be allowed to retain and sell legal sized swordfish caught under the auspices of an exempted fishing permit.

(9) *To what degree are the effects on the quality of the human environment expected to be highly controversial?*

NMFS does not believe that the action will be highly controversial since few comments were received from the public regarding this proposed exempted fishing activity when solicited via a recent Federal Register Notice in August 2004 (69 FR 51636) and given that the research applicants have greatly reduced the scope and magnitude of the planned research since comment was originally requested. These exempted fishing permits would address needed research aimed at reducing bycatch and regulatory discards of targeted species consistent with the conservation and management objectives of the MSA and ATCA.

10) *Can the action be reasonably expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?*

This action has few impacts on property within the United States and would mainly impact domestic vessels fishing for HMS from the Atlantic Ocean between 3 and 200 nautical miles from shore.   Therefore, there are no direct impacts on terrestrial, riverine, and cultural resources or ecologically critical areas.

11) *To what degree are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?*

Effects on the human environment are not likely to be highly uncertain and do not involve unique risks. Approval of exempted fishing permits aimed at reducing bycatch and avoiding regulatory discards would result in predictable, beneficial impacts to the human environment by promoting sustainable HMS stocks.

12) *Is the action related to other actions with individually insignificant, but cumulatively significant impacts?*

The rule is not expected to result in cumulative adverse effects that could have a substantial effect on target or non-target species. As stated in Section 4.0, the monitored catch level of target, non-target, and protected species will not be impacted by this action.

13) *Is the action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?*

This action will not affect any of the sites or objects listed above.

14) *Can the action be reasonably expected to result in the introduction or spread of a nonindigenous species?*

This action will not result in the introduction or spread of nonindiginous species.

15) *Is the action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?*

This action is not likely to establish a precedent for future actions.

16) *Can the action be reasonably expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?*

This action is consistent with all other relevant laws.

17) *Can the action be reasonably expected to result in beneficial impacts, not otherwise identified and described above?*

The action could reduce bycatch consistent with the MSA. Furthermore, the research and information technology gained as a result of these experiments could be promoted and shared with other nations experiencing similar bycatch and discard issues.

DETERMINATION

In view of the information presented in this document and the analyses contained in the attached Environmental Assessment prepared regarding the approval of exempted fishing permits to conduct scientific research experiments using pelagic longline gear in the Gulf Of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean, it is hereby determined that this action will not significantly impact the quality of the human environment as described above and in the Environmental Assessment. In addition, all impacts to potentially affected areas, including national, regional and local, have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not necessary.

William T. Hogarth, Ph.D. Assistant Administrator for Fisheries, NMFS	Date

TABLE OF CONTENTS

1.0 PURPOSE AND NEED FOR ACTION

1.1 Management History

EFPs are requested and issued under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) and/or the Atlantic Tunas Convention Act (16 U.S.C. 971 et seq.). Regulations at 50 CFR 600.745 and 50 CFR 635.32 govern scientific research activity, exempted fishing, and exempted educational activity with respect to Atlantic HMS.

1.2 Need for Action and Objectives

The purpose of this action is to approve a limited number of vessels to conduct scientific research experiments using pelagic longline gear in the Gulf Of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean, consistent with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and other domestic regulations. The vessels need exempted fishing permits to authorize activities otherwise prohibited by the regulations contained in Title 50, Part 635 of the Code of Federal Regulations (CFR). The EFPs are necessary to support a Cooperative Research Proposal submitted by the Fisheries Research Institute in partnership with the NMFS Southeast Fisheries Science Center, College of William and Mary, Virginia Institute of Marine Science, School of Marine Science, and the University of California, Santa Cruz Long Marine Lab. In this EA, NMFS considers the ecological, social, and economic impacts of approving these EFPs based upon the review of landings, logbook, and permitting data.

1.3 Other Concerns

There are no other concerns regarding this action.

2.0 SUMMARY OF THE ALTERNATIVES

This section provides a summary and basis for the alternatives considered in this action. The ecological, economic, and social impacts of these alternatives are discussed in later chapters. Alternatives are not necessarily mutually exclusive and may be combined with one another to authorize scientific research in multiple closed areas.

2.1 Specifically Authorized Activities

The Fisheries Research Institute (FRI) has submitted three separate exempted fishing permit (EFP) applications on behalf of six pelagic longline vessels to evaluate bycatch reduction technology in the Gulf of Mexico, Florida East Coast, South Atlantic Bight, Mid-Atlantic Bight, and Northeast Coastal statistical areas of the Atlantic Ocean. The EFPs are necessary to support a Cooperative Research Proposal submitted by the Fisheries Research Institute in partnership with the NMFS Southeast Fisheries Science Center, College of William and Mary, Virginia Institute of Marine Science, School of Marine Science, and the University of California, Santa Cruz Long Marine Lab.

Research is proposed within, under restricted access, and outside of existing closed areas. To conclusively demonstrate effectiveness, in the shortest time frame, this research will need to test bycatch reduction measures in those areas (i.e., closed areas) where pelagic longlines are most likely to encounter the bycatch species of concern (i.e., HMS species). Research within the closed areas is necessary to compare control and treatment catches/species composition to historic catch information. Participating vessels would adhere to existing pelagic longline (PLL) regulations (69 FR 40734) regarding the use of circle hooks and sea turtle safe handling and release guidelines. This research is aimed at achieving the following objectives:

- Collection of data on the spatial and temporal relationship between target and bycatch species;
- Evaluation of "immediate" mortality using circle hooks;
- Evaluation of bycatch reduction potential for 18/0 10° offset hook with threaded Boston mackerel bait and 18/0 non-offset circle hooks with single hooked Boston mackerel bait on all swordfish directed bycatch species;
- Evaluation of bycatch reduction potential for 18/0 10° offset and 18/0 non offset circle hook designs and whole squid bait on all directed bigeye tuna fishing bycatch species;
- Evaluation of bycatch reduction potential for 16/0 non offset circle hook with threaded Spanish sardine bait and 16/0 non-offset circle hook with single hooked Spanish sardine bait on all yellowfin tuna directed bycatch species;
- Evaluation of the effectiveness of line cutters and de-hookers for releasing bycatch species; and

- Evaluation of the utility of retaining dead undersized swordfish for controlled food-bank donation

Because this research is anticipated to occur inside of existing time/area closures and retention of undersized swordfish is requested per research/design protocols, exempted fishing permits are required.

2.2 Exempted Fishing Permits

Alternative 1: *Deny EFP applications to conduct scientific research in closed regions of the Gulf of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean – NO ACTION*

This alternative would maintain existing regulations, which prohibit PLL in closed regions of the Gulf of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), and *Northeast* Coastal (NEC) statistical areas of the Atlantic Ocean. Therefore, no further consideration of the application to conduct scientific research in these regions would be afforded.

Alternative 2: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Gulf of Mexico (GOM) statistical areas of the Atlantic Ocean, as requested by FRI*

This alternative would permit two domestic pelagic longline vessels to conduct 100 compensated[1] bycatch reduction fishing sets (approximately 750 hooks per set) within the GOM region during a six month time period (i.e., May-October) determined by historical data as the highest interaction timeframe for the regional bycatch priority species (i.e., juvenile swordfish). Vessels conducting research in the DeSoto Canyon closed area would be allowed to retain undersized swordfish, which cannot be returned to the sea alive for, controlled donation to an NMFS-approved food bank. Vessels would be allowed to offset economic impacts of set compensation by selling legal sized fish caught during exempted fishing operations. One of the participating vessels holds an incidental swordfish permit, which would limit that vessel to retention of only two swordfish per trip. Exemptions from permitting requirements and incidental swordfish retention limits would be necessary to allow this vessel to retain and sell more than two legal-sized swordfish caught as a result of this fishing activity. This scientific research would occur in both inside and outside of the DeSoto Canyon closed area. Access to the DeSoto Canyon closed area would be restricted to offshore of the 250-fathom depth contour. Research vessels would be required to adhere to the July 2004 PLL regulations (69 FR 40734).

1 For the purposes of this research program, a compensated set is the unit of hooks equal to the historical average hooks per set by region. Depending upon weather and other variables at sea, a vessel may need to conduct more than a single set to equal one unit of compensation.

Alternative 3: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Gulf of Mexico (GOM) statistical areas of the Atlantic Ocean, as modified by NMFS to include a no sale provision beyond the existing commercial retention limits (i.e., 2 swordfish) for incidental permit holders conducting research in the DeSoto Canyon closed area*

This alternative would permit two domestic pelagic longline vessels to conduct 100 compensated bycatch reduction fishing sets (approximately 750 hooks per set) within the GOM region during a six month time period (i.e., May-October) determined by historical data as the highest interaction timeframe for the regional bycatch priority species. Directed permit holders of vessels participating in this research would be allowed to offset economic impacts of set compensation by selling legal sized fish caught during exempted fishing operations. However, unlike Alternative A2, incidental permit holders would not be allowed to sell legal-sized swordfish caught, beyond the two swordfish per trip retention limit, during these exempted fishing operations. Scientific research would occur in both inside and outside of the DeSoto Canyon closed area. Access to the DeSoto Canyon closed area would be restricted to offshore of the 250-fathom depth contour. Research vessels would be required to adhere to the July 2004 PLL regulations (69 FR 40734) and would only be allowed to retain undersized swordfish, which cannot be returned to the sea alive for controlled donation to an NMFS-approved food bank.

Alternative 4: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Florida East Coast (FEC) and South Atlantic Bight (SAB) statistical areas of the Atlantic Ocean, as requested by FRI*

This alternative would permit two domestic pelagic longline vessels to conduct 50 compensated bycatch reduction fishing sets (approximately 556 hooks per set) within the South of Cape Hatteras region to be determined by historical data as the highest interaction timeframe for the regional bycatch priority species. A maximum of 12 sets per vessel would occur in the closed area. Vessels would be allowed to offset economic impacts of set compensation by selling legal sized fish caught during exempted fishing operations. This scientific research would occur in closed regions of the Florida East Coast (FEC) and South Atlantic Bight (SAB) statistical areas of the Atlantic Ocean. Access to these closed areas would be limited such that the area between 24º (Southern boundary of closed area South of Key West, FL) and 27º 45' North Latitude would be restricted to offshore of the "Axis" of the Gulf Stream as printed on NOAA Chart #411. Research vessels would be required to adhere to the July 2004 PLL regulations (69 FR 40734) and would only be allowed to retain undersized swordfish, which cannot be returned to the sea alive for controlled donation to an NMFS-approved food bank.

Alternative 5: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean, as requested by FRI*

This alternative would permit two domestic pelagic longline vessels to conduct 50 compensated bycatch reduction fishing sets (approximately 680 hooks per set) within the North of Cape Hatteras region during a three month time period (i.e., May, June, and July) determined by historical data as the highest interaction timeframe for the regional bycatch priority species. A maximum of 12 sets per vessel would occur in the closed area. Vessels would be allowed to offset economic impacts of set compensation by selling legal sized fish caught during exempted fishing operations. This scientific research would occur in closed regions of the Mid-Atlantic Bight (MAB) and *Northeast* Coastal (NEC) statistical areas of the Atlantic Ocean. Access to these closed areas would be restricted to offshore of the 250-fathom depth contour for any research set made during the June closure. Research vessels would be required to adhere to the July 2004 PLL regulations (69 FR 40734) and would only be allowed to retain undersized swordfish, which cannot be returned to the sea alive for controlled donation to an NMFS-approved food bank.

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

United States HMS fishermen encounter many species of fish; some of those are marketable, others are discarded for economic or regulatory reasons. Species frequently encountered are swordfish, tunas, and sharks, as well as billfish, dolphin, wahoo, king mackerel, and other finfish species. On occasion, HMS fishermen also interact with sea turtles, marine mammals, and seabirds, known collectively as “protected” species. All of these species are federally managed, and National Marine Fisheries Service (NMFS) seeks to control anthropogenic sources of mortality. Detailed descriptions of those species are given in the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (NOAA Fisheries, 1999a), the 2003, 2004,and 2005 SAFE Reports (NOAA Fisheries, 2003a, 2004a; NMFS, 2005) and are summarized and updated here. Management of declining fish populations requires decreasing fishing mortality from both directed and incidental fishing. The status of the stocks of concern is summarized below.

3.1 STATUS OF THE STOCKS

With the exception of Atlantic sharks, stock assessments for Atlantic HMS are conducted by ICCAT and its Standing Committee on Research and Statistics (SCRS). In 2002, the SCRS conducted stock assessments for Atlantic white marlin, North and South Atlantic swordfish, bigeye tuna, and bluefin tuna. A stock assessment summary table is presented below (Table 3.1). As established in the HMS FMP, a stock is considered overfished when the biomass level (B) falls below the minimum stock size threshold (MSST), and overfishing occurs when the fishing mortality rate (F) exceeds the maximum fishing mortality threshold (MFMT).

3.1.1 Swordfish

Atlantic swordfish (*Xiphias gladius*) are large migratory predators that range from Canada to Argentina in the West Atlantic Ocean. The management units for assessment purposes are a separate Mediterranean group, and North and South Atlantic groups separated at 5°N (NOAA Fisheries, 2003a). Swordfish live to be more than 25 years old, and reach a maximum size of about 902 lb dressed weight (dw). Swordfish are characterized by having dimorphic growth, where females show faster growth rates and attain larger sizes than males. Young swordfish grow very rapidly, reaching about 130 cm lower jaw-fork length (LJFL) by age two. Females mature between ages two and eight, with 50 percent mature at age five at a weight of about 113 lb dw. Males mature between ages two and six, with 50 percent mature at age three at a weight of about 53 lb dw (Arocha, 1997). Large swordfish are all females; males seldom exceed 150 lb dw. These large pelagic fishes feed throughout the water column on a wide variety of prey including groundfish, pelagics, deep-water fish, and invertebrate. Swordfish show extensive diel migrations and are typically caught on pelagic longlines at night when they feed in surface waters. Swordfish are distributed globally in tropical and subtropical marine waters. Their broad distribution, large spawning area, and prolific nature have contributed to the resilience of the species in spite of the heavy fishing pressure being exerted on it by many nations. During their annual migration, north Atlantic swordfish follow the major currents which circle the north Atlantic Ocean (including the Gulf Stream, Canary and North Equatorial Currents) and the currents of the Caribbean Sea and Gulf of Mexico. The primary habitat in the western north Atlantic is the Gulf Stream, which flows northeasterly along the U.S. coast, then turns eastward across the Grand Banks. North-south movement along the eastern seaboard of the United States and Canada is significant (SAFMC, 1990).

North Atlantic Swordfish (all weights are given in whole weight)

An updated estimate of maximum sustainable yield from production model analyses is 14,340 mt (range 11,500 to 15,500 mt). Since 1997, North Atlantic swordfish catches have been below 14,340 mt; preliminary estimates (reported plus carried over) of catches in 2001, 2002, and 2003 were about 9,980, 9,550, and 11,020 mt, but the most recent years are provisional and probably underestimates. The biomass at the beginning of 2002 was estimated to be 94 percent (range: 75 to 124%) of the biomass needed to produce MSY. This estimate is up from an estimate of 65 percent of MSY in the 1998 assessment. The 2001 fishing mortality rate was estimated to be 0.75 times the fishing mortality rate at MSY (range: 0.54 to 1.06). The replacement yield for the year 2003 was estimated to be about the MSY level. As the TAC for North Atlantic swordfish for 2002 was 10,400 mt, it was considered likely that biomass would increase further under those catch levels. The TAC set for 2003 - 2005 is 14,000 mt (ICCAT Recommendation 02 - 02). Given recent fishing mortality patterns, the spawning biomass likely will increase largely owing to the very large recruitments estimated for 1997 - 2000. Further, given that recent (2002 - 2003) reported catch has been below estimated replacement yield, the North Atlantic swordfish biomass may have already achieved the B_{MSY} level. However, noting the uncertainties inherent in the assessment, the SCRS warned against large increases over the current TAC (SCRS, 2004). The next assessment is scheduled for 2006.

South Atlantic Swordfish

The SCRS noted that reported total catches have been reduced since 1995, as was recommended by the SCRS. SCRS had previously expressed serious concern about the trends in stock biomass of South Atlantic swordfish based on the pattern of rapid increases in catch before 1995 that could result in rapid stock depletion, and in declining CPUE trends of some by-catch fisheries. Standardized CPUE series were available for three fleets, the targeted fishery of European Community (EC)-Spain, and the bycatch fisheries of Chinese Taipei and Japan. There was considerable conflict in trends among the three CPUE series and it is unclear which, if any, of the series tracks total biomass. It was noted that there was little overlap in fishing area among the three fleets, and that the three CPUE trends could track different components (or cohorts) of the population. To address this possibility, an age-structured production model was run as a sensitivity test. For the base case production model, the Committee selected the bycatch CPUE series combined using a simple unweighted mean and the targeted CPUE series. Due to some inconsistencies in the available CPUE trends reliable stock assessment results could not be obtained (SCRS, 2004).

Reported catches of Atlantic swordfish, including discards for the period 1950 – 2003 can be found in Figure 3.1. Estimated fishing mortality rate relative to the F_{MSY} for the period 1959 – 2001 can be found in Figure 3.2. Annual yield for North Atlantic swordfish relative to the estimated MSY can be found in Figure 3.3. A summary of Atlantic swordfish stock status can be found in Table 3.1

U.S. swordfish landings are monitored in-season from reports submitted by dealers, vessel owners and vessel operators, NMFS port agents, and mandatory daily logbook reports submitted by U.S. vessels permitted to fish for swordfish. Starting in 1992, the fishery has been monitored using a scientific observer-sampling program that strives to observe approximately five percent of the longline fleet-wide fishing effort. This serves as a mechanism to observe amounts of bycatch and to verify logbook data.

3.1.2 Atlantic Billfish

3.1.2.1 Blue Marlin

Life History/Species Biology

Blue marlin (*Makaira nigricans*) range from Canada to Argentina in the western Atlantic, and from the Azores to South Africa in the eastern Atlantic. Blue marlin are large apex predators with an average weight of 100-175 kg (220-385 lb). Female blue marlin grow faster and reach a larger maximum size than males. Young blue marlin are one of the fastest growing teleosts, reaching 30-45 kg (66-99 lb) after the first year. The maximum growth rate of these fish is 1.66 cm/day (0.65 inches/day) which occurs at 39 cm LJFL (15.3 inches) (NOAA Fisheries, 1999b). Life expectancy for blue marlin is between 20-30 years based on analysis of dorsal spines.

Estimates of natural mortality rates for billfish would be expected to be relatively low, generally in the range of 0.15 to 0.30, based on body size, behavior and physiology (NOAA Fisheries, 1999b). Sagitta otolith weight is suggested to be proportional to age, indicating that both sexes are equally long-lived, based on the maximum otolith weight observed for each sex. Additionally, predicting age from length or weight is imprecise due to many age classes in the fishery.

Blue marlin have an extensive geographical range, migratory patterns that include trans-Atlantic as well as trans-equatorial movements, and are generally considered to be a rare and solitary species relative to the schooling Scombrids (tunas). Blue marlin are generalist predators feeding primarily on epipelagic fish and cephalopods in coastal and oceanic waters, however, mesopelagic fish and crustaceans associated with rocky, sandy, and reef bottoms are also important components of the diet. Feeding in mesopelagic areas probably takes place at night (Rosas-Alayola *et al.*, 2002). Diet studies of blue marlin off the northeastern coast of Brazil indicate that oceanic pomfret (*Brama brama*) and squid (*Ornithoteuthis antillarum*) were the main prey items and present in at least 50 percent of stomachs. Other important prey species vary by location and include dolphin fishes, bullet tuna (*Auxis. spp*) around the Bahamas, Puerto Rico, and Jamaica, and dolphin fishes and scombrids in the Gulf of Mexico. Stomach contents have also included deep-sea fishes such as chiasmodontids.

Status of the Stock and SCRS Outlook

The last stock assessment for blue marlin was in 2000 using similar methods to the previous assessment (1996), however, data was revised in response to concerns raised since the 1996 assessment. The assessment might reflect a retrospective pattern wherein improvement in estimated biomass ratios result in estimated lower productivity. The 2000 assessment was slightly more optimistic than the 1996 assessment. Atlantic blue marlin are at approximately 40 percent of B_{MSY} and over-fishing has taken place for the last 10-15 years. B_{MSY} is estimated at 2,000 mt (4,409,245 lb) and current fishing mortality is approximately four times higher than F_{MSY} (Table 1; SCRS, 2004). There is uncertainty in the assessment because the historical data that is not well quantified. The 2000 assessment estimated that over-fishing was still occurring and that productivity (MSY and a stock's capacity to replenish) was lower than previously estimated, it is expected that landings in excess of estimated replacement yield would result in further stock decline (SCRS, 2004).

No additional assessment information became available in 2004 to modify recommendations currently in force. The current assessment indicates that the stock is unlikely to recover if the landings contemplated by the 1996 ICCAT recommendation continue into the future. While there is additional uncertainty in stock status and replacement yield estimates do not reflected in bootstrap results, these uncertainties can only be addressed through substantial investment in research into habitat requirements of blue marlin and further verification of historical data. The SCRS recommended that the ICCAT take steps to reduce the catch of blue marlin as much as possible, including: reductions in fleet-wide effort, a better estimation of dead discards, establishment of time area closures, and scientific observer sampling for verification of logbook data. The SCRS noted that future evaluation of management measures relative to the recovery of the blue marlin stock are unlikely to be productive unless new quantitative information on the biology and catch statistics of blue marlin, and additional years of data are available (SCRS, 2004).

A summary of Atlantic blue marlin stock assessment data can be found in Table 3.1. Estimated catches of Atlantic blue marlin by region for the period 1956 – 2001 can be found in Figure 3.4. A composite CPUE series for blue marlin for the period 1955 – 2000 can be found in Figure 3.5. The estimated median relative fishing mortality trajectory for Atlantic blue marlin can be found in Figure 3.6.

3.1.2.2 White Marlin

Life History/Species Biology

White marlin (*Tetrapturus albidus*) are found exclusively in tropical and temperate waters of the Atlantic Ocean and adjacent seas, unlike sailfish and blue marlin, which are also found in the Pacific Ocean. White marlin are found at the higher latitudes of their range only in the warmer months. Junior *et al.* (2004) captured white marlin with pelagic longline gear off northeastern Brazil in depths ranging from 50-230 m (164-754 feet), with no obvious depth layer preference. White marlin generally prefer water temperatures above 22°C (71° F) with salinities between 35-37 ppt (NOAA Fisheries, 1999b). They may occur in small, same-age schools, however, are generally solitary compared to the Scombrids (tunas). Catches in some areas may include a rare species (*Tetrapturus georgei*) which is superficially similar to white marlin. The so-called "hatchet marlin" may also represent (*T. georgei),* and has been caught occasionally in the Gulf of Mexico (NOAA Fisheries, 1999b).

White marlin are generally 20-30 kg (44-66 lb) at harvest. These fish grow quickly, with females attaining a larger maximum size than males, and have a life span of 18 years (SCRS, 2004). Adult white marlin grow to over 280 cm (110 inches) TL and 82 kg (180 lb). White marlin exhibit sexually dimorphic growth patterns; females grow larger than males, but the dimorphic growth differences are not as extreme as noted for blue marlin. The longest time at liberty for a tagged white marlin was 4,305 days (11.8 years).

This species undergoes extensive movements, although not as extreme as those of the bluefin tuna and albacore. Trans-equatorial movements have not been documented for the species. White marlin are primarily piscivorous. Oceanic pomfret and squid were the most important food items in a study that sampled sailfish stomachs collected off the coast of Brazil in the southwestern Atlantic Ocean (Junior *et al.*, 2004). The number of food items per stomach ranged from 1-12 individuals. The largest prey observed in white marlin stomachs were snake mackerel (*Gempylus serpens*), that were 40-73 cm (15.7-28.7 inches) in length (Junior *et al.*, 2004). Squid, dolphin, hardtail jack, flying fish, bonitos, mackerels, barracuda, and puffer fish are the most important prey items in the Gulf of Mexico.

Status of the Stock and SCRS Outlook

White marlin have been managed under a single stock hypothesis by ICCAT since 2000. The most recent stock assessments for white marlin (1996, 2000, and 2002) all indicated that biomass of white marlin has been below B_{MSY} for more than two decades and the stock is overfished. In 2004, the SCRS indicated that in spite of significant improvements in the relative abundance estimates made available during the last three assessments, they are still not informative enough to provide an accurate estimate of stock status (SCRS, 2004). The 2002 assessment indicated that the relative fishing mortality is 8.28 times that permissible at F_{MSY} (Table 3.1). Given that the stock is severely depressed, the SCRS concluded that ICCAT should take steps to reduce the catch of white marlin by as much as possible, first by increasing observer coverage to improve estimates of catch and dead discards of white marlin. Furthermore, SCRS recommended that Contracting Parties conduct research into habitat requirements and post-release survival of white marlin and take steps to verify historical fishery data.

The SCRS suggested that ICCAT take steps to make sure that the intended reductions in catch are complied with, and monitored, so that proper evaluation can be carried out in the future. The SCRS recommended improving observer programs so that better estimates of catch and dead discards of white marlin are obtained. The SCRS further recommended that, in the absence of observing a change in population status resulting from the most recent management measures, the potential for increasing stock size of white marlin may require future catches to be reduced beyond the level apparently intended by its most recent recommendations. However, the SCRS also stated that more definitive advice should be available after several years of data become available. The SCRS also noted that future evaluation of management measures relative to the recovery of the white marlin stock are unlikely to be productive unless new quantitative information on the biology and catch statistics of white marlin, and additional years of data, are available (SCRS, 2004). As such, ICCAT postponed the next white marlin assessment until 2006 or later. A summary of Atlantic white marlin stock assessment data can be found Table 3.1 and Figure 3.7.

3.1.2.3 Sailfish

Life History/Species Biology

Sailfish have a pan-tropical distribution and prefer water temperatures between 21 and 28°C (69-82°F). Although sailfish are the least oceanic of the Atlantic billfish and have higher concentrations in coastal waters (more than any other Istiophorid), they are also found in offshore waters. They range from 40°N to 40°S in the western Atlantic and 50°N to 32°S in the eastern Atlantic. No trans-Atlantic movements have been recorded, suggesting a lack of mixing between east and west. Although sailfish are generally considered to be rare and solitary species relative to the schooling Scombrids, sailfish are known to occur along tropical coastal waters in small groups consisting of at least a dozen individuals. Junior *et al.* (2004) captured sailfish in the southwestern Atlantic Ocean with pelagic longline gear at depths between 50-210 m (164-688 feet), with most individuals captured at 50 m. Sailfish are the most common representative of the Atlantic Istiophorids in U.S. waters (SCRS, 2004). Female sailfish grow faster, and attain a larger maximum size, than males while both sexes have a life expectancy of 15 years (NOAA Fisheries, 1999b).

Sailfish are generally piscivorous, but also consume squid. Larvae eat copepods early in life then switch to fish at 6.0 mm (0.2 inches) in length (NOAA Fisheries, 1999b). The diet of adult sailfish caught around Florida consists mainly of pelagic fishes such as little tunny (*Euthynnus alletteratus*), halfbeaks (*Hemiramphus* spp.), cutlassfish (*Trichiurus lepturus*), rudderfish (*Strongylura notatus*), jacks (*Caranx spp.*), pinfish (*Lagodon* *rhomboides*), and squids (*Argonauta argo* and *Ommastrephes bartrami)*. Sailfish are opportunistic feeders and there is evidence that they may feed on demersal species such as sea robin (*Triglidae*), cephalopods and gastropods found in deep water.

Status of the Stock and SCRS Outlook

Sailfish and longbill spearfish landings have historically been reported together in annual ICCAT landing statistics. An assessment was conducted in 2001 for the western Atlantic sailfish stock based on sailfish/spearfish composite catches and sailfish "only" catches. The assessment tried to address shortcomings of previous assessments by improving abundance indices and separating the catch of sailfish from that of spearfish in the offshore longline fleets. The 2001 assessment looked at catches reported between 1956-2000 and all the quantitative assessment models used produced unsatisfactory fits, therefore the SCRS recommended applying population models that better accounted for these dynamics in order to provide improved assessment advice. For the western Atlantic stock, annual sailfish catches have averaged about 700 mt ww (1,543,235 lb) over the past two decades and the abundance indices have remained relatively stable. The 2000 yield was 506 mt ww (1,115,539 lb) (SCRS, 2004). Recent analyses did not provide any information on the MSY or other stock benchmarks for the 'sailfish only' stock. In the eastern Atlantic, abundance indices based on coastal/inshore fisheries for sailfish have decreased in recent years, while those attained from the Japanese longline fishery, indicate constant estimates of abundance since the mid-1970s (SCRS, 2004).

Based on the 2001 assessment, it is unknown if the western or eastern sailfish stocks are undergoing overfishing or if the stocks are currently overfished. Therefore SCRS recommended that Contracting Parties consider methods to reduce fishing mortality rates, overall, and that western Atlantic catches should not be increased above current levels. Furthermore, the SCRS expressed concerned about the incomplete reporting of catches, particularly in recent years.

Management recommendations made by the SCRS in 2004 were the same as those made in 2003. These management recommendations indicated that ICCAT should consider methods for reducing fishing mortality rates. The current western Atlantic assessment led the SCRS to recommend that the West Atlantic sailfish "only" catches should not exceed current levels. For the East Atlantic, the SCRS recommended that sailfish "only" catches should not exceed current levels and that ICCAT should consider practical and alternative methods to reduce fishing mortality and assure data collection systems. SCRS expressed concern about the incomplete reporting of catches, particularly for the most recent years, the lack of sufficient reports by species, and evaluations of the new methods used to split the sailfish and spearfish catch and to index abundance. The SCRS recommended all countries landing sailfish/spearfish or having dead discards, report these data to the ICCAT Secretariat and that the SCRS should consider the possibility of a spearfish "only" assessment in the future (SCRS, 2004).

A summary of Atlantic sailfish stock assessment data is given in Table 3.1. The evolution of estimated sailfish/spearfish catches in the Atlantic during the period 1956–2002 for both east and west stocks in Figure 3.8. Available CPUE for western Atlantic sailfish/spearfish for the period 1967-2000 is shown in Figure 3.9. Estimated sailfish only catches from 1956-2000 is shown in Figure 3.10.

3.1.2.4 Longbill Spearfish

Life History/Species Biology

The longbill spearfish (*Tetrapturus pfluegeri*) are the most rare of the Atlantic istiophorids, and were identified as a distinct species in 1963. There is relatively little information available on spearfish life history. A related istiophorid, the Mediterranean spearfish (*Tetrapturus belone*), is the most common representative of this family in the Mediterranean Sea. Longbill spearfish are known to occur in epipelagic waters above the thermocline, off the east-coast of Florida, the Bahamas, the Gulf of Mexico, and from Georges Bank to Puerto Rico. Junior *et al.* (2004) captured spearfish off the coast of Brazil at depths ranging from 50-190 m (164 – 623 feet). The geographic range for this species is from 40°N to 35° S.

Common prey items include fish and squid. Specifically, Junior *et al.* (2004) observed 37 stomachs and found that oceanic pomfret and squid comprised 63 percent of the items identified in stomachs. Most prey items were between 1-10 cm (0.39-3.9 inches) in length, with a mean length of 6.7 cm (2.63 inches). The maximum number of prey items found in any individual stomach was 33.

State of the Stock and SCRS Outlook

Initial stock assessments conducted on spearfish aggregated these landings with sailfish. As mentioned in the Sailfish section, the 2001 assessment included a 'sailfish only' in addition to an aggregate sailfish/spearfish assessment. West Atlantic catch levels for sailfish/spearfish combined seem sustainable because over the past two decades CPUE and catch levels have remained constant, however, MSY is unknown. As a result, it is unknown whether or not spearfish are experiencing overfishing or are overfished. Spearfish catch levels are shown in Figure 3.11. The SCRS recommends implementing measures to reduce, or keep fishing mortality levels constant and evaluations of new methods to split sailfish and spearfish indices of abundance (SCRS, 2004).

Management recommendations are similar to those listed for sailfish, including: consider methods for Contracting Parties to reduce mortality rates, encourage Contracting Parties to provide complete reporting of spearfish catches, evaluate new methods to split the sailfish and spearfish catch/index abundance, and assess sailfish independently of spearfish.

3.1.3 Atlantic Tunas

Tunas are members of the family Scombridae in the suborder Scombroidei, which they share with swordfish (family Xiphiidae) and billfishes (family Istiophoridae). Atlantic tunas are wide-ranging in size; skipjack tuna is less than one meter (18 kg) as an adult, and the giant bluefin tuna can grow to more than three meters in length (675 kg or 1485 lbs). The Atlantic tunas include some of the largest and fastest predators in the oceans, and their physiological adaptations reflect that role in the ocean's ecosystems. Tuna have among the highest metabolic rates, fastest digestion rates, and the most extreme specializations for sustained levels of rapid locomotion of any fish (Helfman *et al.*, 1997).

Many of these characteristics are common among HMS. The tunas' body shape, round or slightly compressed in cross section, minimizes drag as they move through the water. Their lunate tails are deeply forked. These adaptations for speed are further enhanced by depressions on the body surface, which are shaped to hold the fins in a streamlined position. Small dorsal and ventral finlets minimize turbulence and allow the tail to propel the fish forward more efficiently. Tunas utilize a respiratory mode known as ram gill ventilation, which differs from the more common mechanism whereby water is actively pumped across the gills. Ram gill ventilation requires that the fish swim continuously with its mouth open to maintain water flow across the gill surfaces. It is believed that this system helps conserve energy for voracious fishes like the tunas (Helfman *et al*., 1997).

Tunas are endothermic, with a physiological mechanism to control their body temperature. These fishes maintain an elevated body temperature by conserving the heat generated by active swimming muscles. This enables tunas to dive into colder and deeper water, giving them an edge in overtaking their prey. Heat conservation is accomplished through an adaptation of the circulatory system. The internal temperatures of these fishes remain fairly stable even as they move from surface waters to colder deep water. Bluefin tuna keep muscle temperatures between 28° and 33°C while swimming through waters ranging from 7° to 30°C, while yellowfin and skipjack tunas maintain muscle temperatures at about 3°C or 4° to 7°C above ambient water temperatures, respectively.

Tunas move thousands of kilometers annually throughout the world's tropical, subtropical, and temperate oceans and adjacent seas, primarily in the upper 100 to 200 meters of open ocean. As adults and juveniles, they feed on a variety of fishes, cephalopods, and crustaceans, depending on seasonal prey availability. The foraging and movement patterns of tunas reflect the distribution and scarcity of appropriate prey in the open seas; these fishes must cover vast expanses of the ocean in search of sufficient food resources. Consequently, aggregations of tunas are often correlated with areas where higher densities of prey are found, such as current boundaries, convergence zones, and upwelling areas (Helfman *et al*., 1997).

3.1.3.1 *Atlantic Bluefin Tuna*

Life History/Species Biology

In west Atlantic waters, bluefin tuna (*Thunnus thynnus*) reach maturity at about 196 cm (77 inches) straight fork length, and 145 kg (320 lbs). Bluefin tuna of this size are believed to be about eight years old. Stock assessments assume that the spawning population consists of all bluefin tuna eight years and older. Although each spawning Atlantic bluefin tuna produces approximately 30 million eggs, natural mortality on juvenile bluefin tuna is high (National Research Council, 1994). Bluefin tuna have a relatively long life span (20 years or more), which means that the stock consists of several age classes, a condition that serves as a buffer against adverse environmental conditions and that confers some degree of stability on the stock. As opportunistic feeders that can migrate long distances in search of prey, bluefin tuna may also be quite resilient to fluctuations in prey concentrations, although changes in prey availability may greatly influence fishing patterns.

Bluefin tuna are distributed from the Gulf of Mexico to Newfoundland in the west Atlantic, from roughly the Canary Islands to south of Iceland in the east Atlantic, and throughout the Mediterranean Sea. Bluefin tuna spend a large part of the year feeding in temperate waters, returning to the warm waters of the Gulf of Mexico to spawn (Helfman *et al*., 1997). Trans-Atlantic migrations are well-documented, although migration patterns and their significance to species life history are not well known.

In 1982, ICCAT established a line for separating the eastern and western Atlantic management units based on discontinuities in the distribution of catches at that time in the Atlantic and supported by limited biological knowledge. The two management units for Atlantic bluefin tuna are separated at 45° W above 10° N and at 25° W below the equator, with an eastward shift in the boundary between those parallels. The United States is allocated quota from the western Atlantic management unit where the U.S. fisheries primarily occur. However, the overall distribution of the catch in the 1990s is much more continuous across the North Atlantic than was seen in previous decades. Tagging evidence indicates that movement of bluefin across the current east/west management boundary in the Atlantic does occur, that movements can be extensive (including transatlantic) and complex, that there are areas of concentration of electronically tagged fish (released in the west) in the central North Atlantic just east of the management boundary, and that fisheries for bluefin tuna have developed in this area in the last decade. At least some of these fish have moved from west of the current boundary.

SCRS Recent Stock Assessment Results

The last full stock assessments for western Atlantic Bluefin tuna were conducted in 2002 with the next scheduled for 2006. The assessment results are similar to those from previous assessments. They indicate that the spawning stock biomass (SSB) declined steadily from 1970 (the first year in the assessment time series) through the late 1980s, before leveling off at about 20 percent of the level in 1975 (which has been a reference year used in previous assessments) (Figure 3.12a). A steady decline in SSB since 1997 is estimated and leaves SSB in 2001 at 13 percent of the 1975 level. The assessment also indicates that the fishing mortality rate during 2001 on the spawning stock biomass (SSB) is the highest level in the series (Figure 3.12c).

Estimates of recruitment of age one fish have been generally lower since 1976. However, recruitment of age one fish in 1995 and 1998 is estimated to be comparable in size to some of the year-classes produced in the first half of the 1970s (Figure 3.12b). While the large decline in SSB since the early 1970s is clear from the assessment, the potential for rebuilding is less clear. Key issues are the reasons for relatively poor recruitment since 1976, and the outlook for recruitment in the future. One school of thought is that recruitment has been poor because the SSB has been low. If so, recruitment should improve to historical levels if SSB is rebuilt. Another school of thought is that the ecosystem changed such that it is less favorable for recruitment and thus recruitment may not improve even if SSB increases. To address both schools of thought, the SCRS considered two recruitment scenarios. One scenario assumed that future recruitment will approximate the average estimated recruitment since 1976, unless spawning stock size declines to low levels. The second scenario anticipated an increase in recruitment corresponding to an increase in spawning stock size up to a maximum level no greater than the average recruitment for 1970 - 1974. These scenarios were referred to as the low recruitment and high recruitment scenarios, respectively.

The results of projections based on the low recruitment scenario for the Atlantic stock indicated that a constant catch of 2,500 mt per year has a 97 percent probability of allowing rebuilding to the associated BMSY level by 2018. A constant catch of 2,500 mt per year has about a 35 percent probability of allowing rebuilding to the 1975 stock size (SSB75) by 2018. The SCRS notes that, arguably SSB75 is appropriate as a target level for interpreting the implications of projections based on the high recruitment scenario. Under the high recruitment scenario, a constant catch of about 2,500 mt has about a 60 percent probability of allowing rebuilding to the 1975 stock size; a catch of 2,700 has about a 52 percent chance of reaching this stock size. The SCRS cautioned that these conclusions do not capture the full degree of uncertainty in the assessments and projections. The immediate rapid projected increases in stock size are strongly dependent on estimates of high levels of recent recruitment, which are the most uncertain part of the assessment. The implications of stock mixing between the east and West Atlantic add to the uncertainty. For more information see Section 2.2.2 of the 2003 SAFE Report (NOAA Fisheries, 2003a).

3.1.3.2 *Atlantic Bigeye Tuna*

Life History/Species Biology

Atlantic bigeye tuna (*Thunnus obesus*) are widely distributed in tropical and temperate waters between 45 degrees N and 45 degrees S latitudes. Young bigeye tuna form schools near the sea surface, mixing with other tuna such as yellowfin and skipjack tunas. Bigeye tuna reach sexual maturity at about four years of age, at which point they are approximately 100 cm long (40 inches). They spawn throughout the year in tropical waters from 15 degrees N to 15 degrees S. Catch information from the surface fisheries indicates that the Gulf of Guinea is a major nursery ground for the species. ICCAT recognizes a single Atlantic stock for management purposes, although the possibility of other scenarios, such as north and south Atlantic stocks, should not be disregarded (SCRS, 1997).

Catch of undersized fish remains a major problem in the Atlantic bigeye tuna fishery. The share of bigeye tuna less than the ICCAT minimum size (3.2 kg) is estimated at up to 59 percent by number of all bigeye tuna harvested. At its 2000 meeting, ICCAT adopted a recommendation that established the first-ever catch limits for bigeye tuna, which went into effect in 2001. These measures were continued for 2002 and 2003. While these measures will not be sufficient to rebuild the stock, bigeye tuna catches in 2000 (100,413 mt) and 2001 (96,482 mt) were down significantly from the 1999 level of 120,883 mt - first steps toward rebuilding (NOAA Fisheries, 2003a).

ICCAT currently manages Atlantic bigeye tuna based on an Atlantic-wide single stock hypothesis. However, the possibility of other scenarios, including north and south stocks, does exist, and should not be disregarded (SCRS, 2002). The latest stock assessment of Atlantic bigeye tuna was conducted in October 2002. The assessment was hampered by a paucity of information about illegal, unregulated, or unreported (IUU) catches, limited Ghanian fishery statistics, and the lack of a reliable index of abundance for small bigeye tuna. An estimate of natural mortality for juvenile fish was computed, which will help reduce uncertainty in future assessments.

SCRS Recent Stock Assessment Results

A new stock assessment was conducted for bigeye tuna in July 2004. Due to the early date of the meeting, the catch information for 2003 was incomplete and could not be incorporated in the assessment. The 2004 stock assessment was conducted using various types of models. However, there were considerable sources of uncertainty arising from the lack of information regarding (a) reliable indices of abundance for small bigeye from surface fisheries, (b) the species composition of Ghanaian fisheries that target tropical tunas, and (c) details on the historical catch and fishing activities of Illegal, Unregulated, Unreported (IUU) fleets (e.g., size, location and total catch).

Three indices of relative abundance were available to assess the status of the stock (Figure 3.13). All were from longline fisheries conducted by Japan, Chinese Taipei and United States. While the Japanese indices have the longest duration since 1961 and represent roughly 20-40 percent of the total catch, the other two indices are shorter and generally account for a smaller fraction of the catch than the Japanese fishery. These three indices primarily relate to medium and large-size fish.

Various types of production models were applied to the available data and the SCRS notes that the current year's model fits to the data were better than in past assessments, although they required similar assumptions regarding stock productivity. The point estimates of MSY obtained from different production models ranged from 93,000 mt to 113,000 mt. The lower limit of this range is higher than the one estimated in the 2002 assessment, probably due to the revised indices and the addition of a new index. An estimate obtained from another age-aggregated model was 114,000 mt. The inclusion of estimation uncertainty would broaden this range considerably.

These analyses estimate that the total catch was larger than the upper limit of MSY estimates for most years between 1993 and 1999, causing the stock to decline considerably, and leveling off thereafter as total catches decreased. These results also indicate that the current biomass is slightly below or above (85 – 107 percent) the biomass at MSY (Figure 3.14), and that current fishing mortality is also in the range of 73 percent to 101 percent of the level that would allow production of MSY (Table 3.1). However, indications from the most targeted and wide-ranging fishery are of a more pessimistic status than implied by these model results. Several types of age-structured analyses were conducted using the above-mentioned longline indices from the central fishing grounds and catch-at-age data converted from the available catch-at-size data. In general, the trajectories of biomass and fishing mortality rates are in accordance with the production model analyses. Model fits appeared improved over those of past assessments, apparently as a result of using a new growth curve for the calculation of catch at age.

SCRS Outlook

Stock projections were conducted based on the production model results, assuming a catch of 75,480 mt in 2003 and varying levels of constant catch thereafter. The projection results suggest that the biomass of the stock will likely decline further with constant catches of 100,000 mt or more. On average, increases in biomass are expected with catches of 90,000 mt or less. However, due to uncertainty, there is a non-negligible probability of further decline of the stock with a constant future catch of 100,000 mt or more.

3.1.3.3 *Atlantic Yellowfin Tuna*

Life History/Species Biology

Yellowfin tuna (*Thunnus albacores*) are fast-growing, reaching sexual maturity at a size of about 25 kg (55 lbs) and 110 cm (44 inches), corresponding to an age of about three years (SCRS, 1997). The maximum size of yellowfin tuna is over 200 cm fork length. In the Atlantic, the greatest concentrations are found within 15 degrees north or south of the equator. Yellowfin tuna may be found seasonally as far north and south as the northeastern United States and Uruguay, with substantial concentrations occurring in the Gulf of Mexico during spring and summer months. Their distribution is determined by water temperature and the availability of prey species such as pelagic fishes and squids.

Yellowfin tuna is a schooling species, with juveniles found in schools at the surface mixing with skipjack and bigeye tuna. Larger fish are found in deeper water and also extend their ranges into higher latitudes than smaller individuals. The main spawning ground in the Atlantic Ocean is the Gulf of Guinea near the equator, with spawning occurring from January to April (SCRS, 1998). Individual fish may spawn repeatedly during a single spawning season. All individuals in the Atlantic probably comprise a single population, but movement patterns are not well known (SCRS, 1997).

Based on movement patterns, as well as other information (e.g., time-area size frequency distributions and locations of fishing grounds), ICCAT manages Atlantic yellowfin tuna based on an Atlantic-wide single stock hypothesis. A full assessment was conducted for yellowfin tuna in 2003 (SCRS, 2003) applying various age-structured and production models to the available catch data through 2001. At the time of the assessment meeting, only 19 percent of the 2002 catch had been reported (calculated relative to the catch reports available at the time of the SCRS Plenary). The results from all models were considered in the formulation of the Committee's advice. Both equilibrium and non-equilibrium production models were examined in 2003. The effective effort used for the production models was calculated by first creating a combined index from the available abundance indices by fleet and gear, and weighting each index by the catch of that fishery. One of the non-equilibrium models applied estimated the annual effective fishing effort internally, allowing the fishing power trends by fleet to vary (see Table 3.1).

The estimate of maximum sustainable yield (MSY) based upon the equilibrium models ranged from 151,300 to 161,300 metric ton (mt); the estimates of F2001/FMSY ranged from 0.87 to1.29. The point estimate of MSY based upon the non-equilibrium models ranged from147,200-148,300 mt. The point estimates for F2001/FMSY ranged from 1.02 to 1.46; the main differences in the results were related to the assumptions of each model. The Committee was unable to estimate the level of uncertainty associated with these point estimates (NOAA Fisheries, 2004a).

SCRS Recent Stock Assessment Results

In summary, the age-structured and production model analyses implied that although the 2001 catches of 159,000 mt were slightly higher than MSY levels, effective effort may have been either slightly below or above (up to 46 percent) the MSY level, depending on the assumptions. Consistent with these model results, yield-per-recruit analyses also indicated that 2001 fishing mortality rates could have been either above or about the level which could produce MSY. Yield-per-recruit analyses further indicated that an increase in effort is likely to decrease the yield-per-recruit, while reductions in fishing mortality on fish less than 3.2 kg could result in substantial gains in yield-per-recruit and modest gains in spawning biomass-per-recruit.

SCRS Outlook

Since reported yellowfin tuna landings in 2001 appeared to be somewhat above the MSY level estimated during the 2003 assessment and fishing effort and fishing mortality may have been in excess of the levels associated with MSY, it is important to ensure that effective effort does not increase beyond the 2001 level. Projections indicate that stock biomass is likely to decrease if fishing mortality increases to the level estimated for 1992, which is currently being approached or exceeded. Thus the possibility that the fishing power of the purse seiners and other fleets may further increase, even if the total capacity of the fleet were to remain constant, is also cause for concern. It should be noted that the current estimates of total yellowfin landings in 2002 and 2003, which were not available at the time of the assessment, are 139,000 mt and 124,000 t, respectively.

3.1.3.4 *Atlantic Albacore Tuna*

Life History/Species Biology

Albacore tuna (*Thunnus alalunga*) are widely distributed throughout temperate waters of the Atlantic Ocean and the Mediterranean Sea, ranging from 50 degrees N to 40 degrees S latitudes. Aggregations are composed of similarly sized individuals, with those groups made up of the largest individuals making the longest journeys. Groups may include other tuna species, such as skipjack, yellowfin, and bluefin. They reach maximum sizes of about 125 cm (50 inches) and maximum weights of about 40 kg (88 lbs). Atlantic albacore tuna are considered mature at the age of five years, corresponding to approximately 90 cm (35 inches) (SCRS, 1998). Albacore tuna spawn in the spring and summer in tropical waters of the Atlantic (ICCAT, 1997).

On the basis of the available biological information, the existence of three stocks of albacore tuna is assumed for assessment and management purposes; northern and southern Atlantic stocks (separated at 5° N) and a Mediterranean stock. U.S. fishermen caught relatively small amounts of albacore from the North Atlantic stock/management unit (322 mt in 2001), and had minor catches of South Atlantic albacore (2 mt in 2001).

SCRS Stock Assessment Results

The last assessment of the North stock was conducted in 2000 (1975-1999) and that of the South stock in 2003; no assessment of the Mediterranean stock has ever been carried out. To coordinate the timing of the assessments of northern and southern albacore tuna, the stock assessment for northern albacore was postponed at the 2004 ICCAT meeting from 2006 to 2007 (note the management measures for northern albacore expire at the end of 2006). The SCRS noted the considerable uncertainty that continues to remain in the catch-at-size data for the North and South stocks, and the profound impact this has had on attempts to complete a satisfactory assessment of northern albacore tuna.

<u>North Atlantic</u>

The SCRS carried out an initial analysis of the state of the northern stock using a model essentially the same as that used in previous assessments. However, revisions to catch-at-size data, provided to the Secretariat during and shortly before the assessment, altered the historical data series. The impacts of these revisions are such that the SCRS concluded that it was not appropriate to proceed with an assessment based on the 2003 catch-at-age. Consequently, the SCRS's opinion of the current state of the northern albacore tuna stock is based primarily on the last assessment conducted in 2000 together with observations of CPUE and catch data provided to the SCRS since then. The results, obtained in 2000, showed consistency with those from previous assessments (see Table 3.1).

The SCRS noted that CPUE trends have varied since the last assessment in 2000, and in particular differed between those representative of the surface fleets (Spain Troll age two and Spain Troll age three) and those of the longline fleets of Japan, Chinese Taipei and the United States. The Spanish age two troll series, while displaying an upward trend since the last assessment, none the less declines over the last ten years. For the Spanish age three troll series the trend in the years since the last assessment is down, however, the trend for the remainder of the last decade is generally unchanged. For the longline fleets, the trend in CPUE indices is either upwards (Chinese Taipei and United States) or unchanged (Japan) in the period since the last assessment. However, variability associated with all of these catch rate estimates prevented definitive conclusions about recent trends of albacore catch rates.

Equilibrium yield analyses, carried out in 2000 and made on the basis of an estimated relationship between stock size and recruitment, indicate that spawning stock biomass was about 30 percent below that associated with MSY. However, the SCRS noted considerable uncertainties in these estimates of current biomass relative to the biomass associated with MSY (B_{MSY}), owing to the difficulty of estimating how recruitment might decline below historical levels of stock biomass. Thus, the SCRS concluded that the northern stock is probably below B_{MSY}, but the possibility that it is above it should not be dismissed (Figure 3.15). However, equilibrium yield-per-recruit analyses made by the SCRS in 2000 indicate that the northern stock is not being growth overfished ($F < Fmax$).

South Atlantic

In 2003, an age-structured production model (ASPM), using the same specifications as in 2000, was used to provide a Base Case assessment for South Atlantic albacore. Results were similar to those obtained in 2000, but the confidence intervals were substantially narrower. In part, this may be a consequence of additional data now available, but the underlying causes need to be investigated further. The estimated MSY and replacement yield from the 2003 Base Case (30,915 mt and 29,256 mt, respectively) were similar to those estimated in 2000 (30,274 mt and 29,165 mt). In both 2003 and 2000, the fishing mortality rate was estimated to be about 60 percent of FMSY (Table 3.1). Spawning stock biomass has declined substantially relative to the late 1980s, but the decline appears to have leveled off in recent years and the estimate for 2002 remains well above the spawning stock biomass corresponding to MSY. A statistical (Bayesian) age structured production model was used for the first time in 2003. The results from this model were qualitatively similar to those from the ASPM. Projections were carried out using this alternate model (NOAA Fisheries, 2003a).

SCRS Outlook

North Atlantic

In terms of yield per recruit, the assessment carried out in 2000 indicates that the fishing intensity is at, or below, the fully exploited level. Concerning MSY-related quantities, the SCRS recalls that they are highly dependent on the specific choice of stock-recruitment relationship. The SCRS believed that using a particular form of stock-recruitment relationship that allows recruitment to increase with spawning stock size provided a reasonable view of reality. This hypothesis together with the results of the assessment conducted in 2000 indicate that the spawning stock biomass (B_{1999}) for the northern stock (29,000 mt) was about 30 percent below the biomass associated with MSY (42,300 mt) and that current F (2000) was about 10 percent above F_{MSY}. However, an alternative model allowing for more stable recruitment values in the range of observed SSB values would provide a lower estimate of SSB at MSY, below the current value.

South Atlantic

Catches of albacore in the South Atlantic in 2001 and 2002 were above replacement yield, and were below estimates of MSY in 2003. Nevertheless, both the 2000 and 2003 albacore assessments estimated that the stock is above BMSY. There is now greater confidence in these estimates of MSY and therefore there is justification to base a TAC recommendation on MSY instead of replacement yield estimates from the model as in 2000. This results from the SCRS's view that current stock status is somewhat above BMSY and catch of this level, on average, would be expected to reduce the stock further towards BMSY. Recent estimates of high recruitment could allow for some temporary increase in adult stock abundance under a 31,000 mt catch, but this result is uncertain.

Mediterranean

Given the lack of an assessment, the implications of the rapid increase in landings in unknown.

3.1.3.5 *Atlantic Skipjack Tuna*

Life History/Species Biology

Skipjack tuna (*Katsuwonus pelamis*) are found throughout tropical and warm-temperate seas. The skipjack tuna is a schooling species, forming aggregations associated with hydrographic fronts. These tuna spawn opportunistically throughout the year in vast areas of the Atlantic Ocean. The size at first maturity is about 45 cm (18 inches), slightly smaller for females, which corresponds to about one to one and a half years of age (SCRS, 1997).

Skipjack is a species that is often associated with floating objects, both natural objects or fish aggregating devices (FADs) that have been used extensively since the early 1990s by purse seiners and baitboats (during the 1991 to 2003 period, about 55 percent of skipjack were caught with FADs). The concept of viscosity (low interchange between areas) could be appropriate for the skipjack stocks. A stock qualified as "viscous" can have the following characteristics:

- It may be possible to observe a decline in abundance for a local segment of the stock;
- Overfishing of that component may have little, if any, repercussion on the abundance of the stock in other areas; and,
- Only a minor proportion of fish may make large-scale migrations.

The increasing use of FADs could have changed the behavior of the schools and the migrations of this species. It is noted that, in effect, the free schools of mixed species were much more common prior to the introduction of FADs than now. These possible behavioral changes ("ecological trap" concept) may lead to changes in the biological parameters of this species as a result of the changes in the availability of food, predation and fishing mortality. Skipjack caught with FADs are usually found associated with other species. The typical catch with floating objects is comprised of about 63 percent skipjack, 20 percent small yellowfin, and 17 percent juvenile bigeye and other small tunas. A comparison of size distributions of skipjack between periods prior to and after the introduction of FADs show that, in the East Atlantic, there has been an increase in the proportion of small fish in the catches, as well as a decline in the total catch in recent years in some areas.

The SCRS reviewed the current stock structure hypothesis that consists of two separate management units, one in the East Atlantic and another in the West Atlantic, separated at 30°W. The boundary of 30°W was established when the fisheries were coastal, whereas in recent years the East Atlantic fisheries have extended towards the west, surpassing this longitude, and showing the presence of juvenile skipjack tuna along the Equator, west of 30°W, following the drift of the FADs. This implies the potential existence of a certain degree of mixing. Nevertheless, taking into account the large distances between the east and west areas of the ocean, various environmental constraints, the existence of a spawning area in the East Atlantic as well as in the northern zone of the Brazilian fishery, and the lack of additional evidence (e.g. transatlantic migrations in the tagging data), the hypothesis of separate East and West Atlantic stock is maintained as the most plausible alternative. On the other hand, in taking into account the biological characteristics of the species and the different fishing areas, smaller management units could be considered.

SCRS Recent Stock Assessment Results

The last assessment on Atlantic skipjack tuna was carried out in 1999 (Table 3.1). The state of the Atlantic skipjack stock(s), as well as the stocks of this species in other oceans, show a series of characteristics that make it extremely difficult to conduct an assessment using current models. Among these characteristics, the most noteworthy are:

- The continuous recruitment throughout the year, but heterogeneous in time and area,

making it impossible to identify and monitor the individual cohorts;
- Apparent variable growth between areas, which makes it difficult to interpret the size distributions and their conversion to ages; and,
- Exploitation by many and diverse fishing fleets (baitboat, purse seine), having distinct and changing catchabilities, which makes it difficult to estimate the effective effort exerted on the stock in the East Atlantic.

For these reasons, no standardized assessments have been able to be carried out on the Atlantic skipjack stocks. Notwithstanding, some estimates were made, by means of different indices of the fishery and some exploratory runs were conducted using a new development of the generalized production model.

Eastern stock

Standardized catch rates are not available. However, an analysis was made, for the 1969-2002 period, of the different indices of the purse seine fishery that could provide valuable information on the state of the stock. For the majority of the indices, the trends were divergent, depending on the area, which may indicate the viscosity of the skipjack stock, with limited mixing rates between areas. Because of the difficulties in assigning ages to the skipjack catches, the estimates of the values of natural mortality by age and obtaining indices of abundance (especially for the eastern stock), no catch-by-age matrices were developed and, consequently, no analytical assessment methods were applied.

Western stock

Standardized abundance indices up to 1998 were available from the Brazilian baitboat fishery and the Venezuelan purse seine fishery, and in both cases the indices seem to show a stable stock status. Uncertainties in the underlying assumptions for the analyses prevent the extracting of definitive conclusions regarding the state of the stock. However, the results suggest that there may be over-exploitation within the FAD fisheries, although it was not clear to what extent this applies to the entire stock. The SCRS could not determine if the effect of the FADs on the resource is only at the local level or if it had a broader impact, affecting the biology and behavior of the species. Under this supposition, maintaining high concentrations of FADs would reduce the productivity of the overall stock. However, since 1997, and due to the implementation of a voluntary Protection Plan for Atlantic tunas, agreed upon by the Spanish and French boat owners in the usual areas of fishing with objects, which later resulted in a Commission regulation on the surface fleets that practice this type of fishing, there has been a reduction in the skipjack tuna catches associated with FADs. Maintaining this closure could have a positive effect on the resource.

3.1.4 Atlantic Sharks

Atlantic sharks are managed in several species groups. Many shark species make extensive migrations along the U.S. Atlantic coast. Compared to other fishes, sharks have low reproductive rates that make them particularly vulnerable to overfishing.

NMFS is responsible for conducting stock assessments for the Large and Small Coastal Shark complexes (LCS and SCS) (Cortes, 2002; Cortes *et al.*, 2002). ICCAT and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) have recently conducted assessments of three pelagic species. Stock assessments were conducted for the Large and Small Coastal Shark complexes (LCS and SCS) in 2002. Species-specific assessments for blacktip and sandbar sharks within the LCS complex and finetooth sharks, Atlantic sharpnose sharks, blacknose sharks (*Carcharhinus acronotus*), and bonnethead sharks (*Sphyrna tiburo*) within the SCS complex, were also conducted in 2002. The conclusions of these assessments are summarized in Table 3.2 and Table 3.3 and are fully described in Amendment 1 to the 1999 Atlantic Tunas, Swordfish, and Sharks FMP (NOAA Fisheries, 2003b). Additional information on Atlantic sharks can be found in the HMS FMP (NOAA Fisheries, 1999a), and the 2003 and 2004 Stock Assessment and Fishery Evaluation Reports (NOAA Fisheries, 2003a; 2004a). Summaries of recent stock assessments and reports on several species of pelagic sharks (blue sharks, shortfin mako sharks, and porbeagle sharks (*Lamna nasus*) by COSEWIC and ICCAT are included in this section.

Seventy-three species of sharks are known to inhabit the waters along the U.S. Atlantic coast, including the Gulf of Mexico and the waters around Puerto Rico and the U.S. Virgin Islands. HMS manages seventy-two species; spiny dogfish also occur along the U.S. coast, however management for this species is under the authority of the Atlantic States Marine Fisheries Commission as well as the New England and Mid-Atlantic Fishery Management Councils. Based on a combination of ecology and fishery dynamics the sharks in the management unit have been divided into four species groups for management: (1) large coastal species, (2) small coastal species, (3) pelagic species, and (4) prohibited species (Table 3.4).

3.1.4.1 *Large Coastal Sharks*

Species in the large coastal sharks (LCS) group are the main commercial species and are targeted with bottom longline gear. Sandbar and blacktip sharks make up approximately 60 to 75 percent of the bottom longline catch and approximately 75 to 95 percent of the bottom longline landings (GSAFDF, 1996). The remainder of the bottom longline catch is comprised mostly of bull, bignose, tiger, sand tiger, lemon, spinner, scalloped hammerhead and great hammerhead sharks, with catch composition varying by region. These species are less marketable and are often released, so they are reflected in the overall catch but not the landings. Several LCS can also be caught by pelagic longline gear: silky, dusky, sandbar, and hammerhead sharks. The shark gillnet fishery catches several large coastal species including blacktip (targeted and retained), and scalloped hammerhead (discarded). To a lesser extent, sandbar, bull, spinner, tiger, lemon, and silky sharks are caught and retained in the shark gillnet fishery (NOAA Fisheries, 2002).

3.1.4.2 *Small Coastal Sharks*

Finetooth Sharks

Finetooth sharks inhabit shallow coastal waters to depths of 10 m (32.8 feet) near river mouths in the Gulf of Mexico and South Atlantic Ocean between Texas and North Carolina. These fish often form large schools and migrate to warmer waters when water temperatures drop below 20°C (68°F). Finetooth sharks are relatively productive compared to other sharks as fish are sexually mature at 3.9 (TL = 118 cm [46 inches]) and 4.3 (TL = 123 cm [48 inches]) years for males and females, respectively (Carlson *et al.*, 2003). Reproduction in finetooth sharks is viviparous with yolksac placenta and embryos nourished through a placental connection. Females move into the nursery areas in late May and gestation is approximately 12 months. Each litter can have 1-6 pups with individuals measuring 51-64 cm (20-25 inches) in length. The finetooth shark feeds primarily on mullet, Spanish mackerel, spot, Atlantic menhaden, cephalopods, and crustacean (Bester and Burgess, 2004).

In a 2002 stock assessment, NMFS determined that finetooth sharks are not overfished ($B<B_{MSY}$), but that overfishing is occurring ($F>F_{MSY}$) (Table 3.2). Under National Standard 1 of the Magnuson-Stevens Act, NMFS is required to take measures to reduce fishing mortality. In general, more catch series data were available for the other species of SCS which were assessed simultaneously in 2002, than for finetooth sharks. It was determined that other species in the complex, and the complex as a whole, were not overfished and were not experiencing overfishing. Another limitation of the 2002 finetooth shark stock assessment was that bycatch data from the shrimp fishery was not included. Alternatives for reducing fishing mortality of finetooth sharks are explored in greater detail in Section 2.3.2 of the 2005 SAFE Report (NMFS, 2005).

3.1.4.3 Pelagic Sharks

Pelagic sharks including shortfin mako, porbeagle, common thresher, and blue sharks are commonly taken in the pelagic longline fishery. Pelagic sharks are also sometimes encountered incidentally in the shark gillnet fishery (e.g., thresher sharks, mostly discarded) and bottom longline fishery. Trans-Atlantic migrations of these sharks are common; they are taken in several international fisheries outside the U.S. EEZ (NOAA Fisheries, 2002).

Pelagic sharks are subject to exploitation by many different nations and exhibit trans-oceanic migration patterns. As a result, ICCAT's Standing Committee on Research and Statistics Subcommittee on Bycatch has recommended that ICCAT take the lead in conducting stock assessments for pelagic sharks.

ICCAT Stock Assessment on Blue and Shortfin Mako Sharks

At the 2004 ICCAT annual meeting in New Orleans the commission adopted a recommendation concerning the conservation of sharks caught in association with fisheries managed by ICCAT. This is the first binding measure passed by ICCAT dealing specifically with sharks. This recommendation includes, among other measures: reporting of shark catch data by Contracting Parties, a ban on shark finning, a request for Contracting Parties to live-release sharks that are caught incidentally, a review of management alternatives from the 2004 assessment on blue and shortfin mako sharks, and a commitment to conduct another stock assessment of selected pelagic shark species no later than 2007.

At the 2004 Inter-Sessional Meeting of the ICCAT Sub-Committee on bycatch, stock assessments for Atlantic blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*) were conducted. This work included a review of their biology, a description of the fisheries, analyses of the state of the stocks and outlook, analyses of the effects of current regulations, and recommendations for statistics and research. The assessment indicated that the current biomass of North and South Atlantic blue shark seems to be above MSY ($B>B_{MSY}$), however, these results are conditional and based on assumptions that were made by the committee. These assumptions indicate that blue sharks are not currently overfished, again, this conclusion is conditional and based on limited landings data. The committee estimates that between 82,000 and 114,000 mt ww (180,779,054 - 251,326,978 lb) of blue shark are harvested from the Atlantic Ocean each year.

The North Atlantic shortfin mako population has experienced some level of stock depletion as suggested by the historical CPUE trend and model outputs. The current stock may be below MSY ($B<B_{MSY}$), suggesting that the species may be overfished. Overfishing may also be occurring as between 13,000 and 18,000 mt ww (28,660,094 – 39,683,207 lb) of shortfin mako are harvested in the Atlantic Ocean annually. South Atlantic stocks of shortfin mako shark are likely fully exploited as well, but depletion rates are less severe than in the North Atlantic.

The results of both of these assessments should be considered preliminary in nature due to limitations on quality and quantity of catch data available (SCRS, 2004). The sub-committee stated that catch data currently being reported to ICCAT does not represent the total catch actually landed, and are very limited with regard to size, age, and sex of shark harvested or caught incidentally. In order to attain a more accurate estimate of total landings, and improve future stock assessments, the committee made several recommendations, including: increase the infrastructure investment for monitoring the overall catch composition of sharks, standardize catch per unit effort (CPUE) from major fishing fleets, expand use of trade statistics (fins) to extend historical time series, and include scientists from all Contracting Parties with significant blue and shortfin mako catches in future assessments (SCRS, 2004).

COSEWIC Stock Assessment on Porbeagle

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) conducted a species report and assessment for porbeagle in 2004. They suggest that significant declines in porbeagle abundance have occurred as a result of overexploitation in fisheries. In 2001, porbeagle biomass was estimated at 4,409 mt ww (9,720,181 lb), a decline of 89% from the pre-fishing biomass in 1961 (COSEWIC, 2004). The model employed predicts that populations declined precipitously after the fishery was developed in 1961, recovered slightly in the 1980s, and then declined again to the current level. Porbeagle quotas have been reduced significantly for Canadian fisheries. NMFS is interested in working with the Canadian government to address concerns raised by the COSEWIC report. Currently, NMFS has a species-specific quota of 46 mt dw (101,412 lb) for porbeagle. These fish are generally harvested incidentally in the pelagic longline fisheries. Between 2000 and 2003, landings of porbeagle were approximately 3.4 mt dw for the four fishing years combined.

3.14.4 *Prohibited Shark Species*

In 1999, NMFS prohibited possession of 19 species of sharks. These species were identified as highly susceptible to overexploitation and the prohibition on possession was a precautionary measure to ensure that directed fisheries did not develop. Three species on the prohibited list (i.e., dusky, night, and sand tiger) are also on the Candidate Species List under the ESA (NOAA Fisheries, 2003b).

To date there is little information available regarding the status of individual prohibited species. For the most part, many species that were LCS before 1999 continue to be considered as part of the LCS complex in the latest LCS stock assessment. In 2001, NMFS contracted Virginia Institute of Marine Science (VIMS) to conduct a status review under ESA of the dusky shark (Romine *et al.*, 2001). Additionally, VIMS continues to conduct a fisheries independent longline study off Virginia, which provides valuable information regarding the status of dusky shark. Specifically, relative abundance data (1974-2000) indicates increasing trends in abundance from 1997-2000, despite declines from 1980-1992 (Romine *et al.*, 2001). Catch data, which suggests increasing catch rates from 1994 to 1999, provides evidence that greater numbers of small dusky sharks are being caught. This finding is important considering that hooking mortality increases as shark size decreases. Romine *et al.* (2001) noted that mortality for dusky sharks less than 100 cm fork length was 79 percent, as compared with 37 percent in sexually mature animals (Romine *et al.*, 2001). These data, when combined with other life history information and analyzed by a demographic model, suggest that dusky shark populations will continue to decline so long as fishery-induced mortality is incurred (Romine *et al.*, 2001). NMFS will be conducting status reviews for night and sand tiger sharks in the future (NOAA Fisheries, 2003b).

3.1.5 Other Finfish

Dolphin (*Coryphaena hippurus*) are fast-swimming, pelagic, migratory, and predatory fish found in tropical and subtropical waters throughout the world. They are short-lived and fast growing. These traits allow the stock to support high fishing mortality rates. Also referred to as mahi-mahi, these fish are sold by commercial fishermen (driftnet and pelagic longline) and are targeted by recreational fishermen along the Atlantic and Gulf Coasts (NOAA Fisheries, 2002). Wahoo (*Acanthocybium solanderia*) are large pelagic fish found throughout the tropical and subtropical waters of the Atlantic Ocean. The life history of wahoo is largely unknown, although they are a fast-growing species similar to dolphin. These fish are also landed both recreationally and commercially, although encounter rates seem to be lower than those for dolphin (NOAA Fisheries, 2002).

The South Atlantic Fishery Management Council recently received notice that the Fishery Management Plan for Dolphin and Wahoo in the Atlantic Region has been approved by the U.S. Secretary of Commerce. The management plan, developed by the South Atlantic Council in conjunction with the Mid-Atlantic and New England Councils, will set limits on catches of dolphin and wahoo for commercial and recreational fishermen in federal waters along the entire Atlantic coast. The precautionary management plan also establishes a framework for long-term management of both fish species. Management measures included in the plan and approved by the secretary of commerce include requirements for permits, size limits for dolphin, recreational bag limits for both species, commercial trip limits for wahoo and commercial longline closures in conjunction with current closures in the Atlantic for Highly Migratory Species. The plan also will prohibit the sale of recreationally caught dolphin or wahoo, with the exception of for-hire vessels that possess the appropriate state and Federal commercial permits; those vessels will be allowed to sell dolphin harvested under the bag limit. The FMP establishes a non-binding cap of 1.5 million pounds, or 13 percent of the total landings for the commercial dolphin fishery.

3.2 FISHERY PARTICIPANTS AND GEAR TYPES

The HMS FMP provides a thorough description of the U.S. fisheries for Atlantic HMS, including sectors of the pelagic longline fishery. Below is specific information regarding the U.S. pelagic longline fishery for Atlantic HMS. For more detailed information on the fishery, please refer to the HMS FMP (NOAA Fisheries, 1999a), and the 2000 - 2004 HMS SAFE Reports.

3.2.1 Pelagic Longline Gear

3.2.1.1 Domestic Aspects of the Atlantic Pelagic Longline Fishery

The U.S. pelagic longline fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, and bigeye tuna in various areas and seasons. Secondary target species include dolphin, albacore tuna, pelagic sharks (including mako, thresher, and porbeagle sharks), as well as several species of large coastal sharks. Although this gear can be modified (i.e., depth of set, hook type, etc.) to target swordfish, tunas, or sharks, it is generally a multi-species fishery. These vessel operators are opportunistic, switching gear style and making subtle changes to target the best available economic opportunity of each individual trip. Pelagic longline gear sometimes attracts and hooks non-target finfish with no commercial value, as well as species that cannot be retained by commercial fishermen due to regulations, such as billfish. Pelagic longlines may also interact with protected species such as marine mammals, sea turtles, and seabirds. Thus, this gear has been classified as a Category I fishery with respect to the Marine Mammal Protection Act. Any species (or undersized catch of permitted species) that cannot be landed due to fishery regulations is required to be released, whether dead or alive. Pelagic longline gear is composed of several parts (see Figure 3.16[2]).

The primary fishing line, or mainline of the longline system, can vary from five to 40 miles in length, with approximately 20 to 30 hooks per mile. The depth of the mainline is determined by ocean currents and the length of the floatline, which connects the mainline to several buoys and periodic markers which can have radar reflectors or radio beacons attached. Each individual hook is connected by a leader to the mainline. Lightsticks, which contain chemicals that emit a glowing light are often used, particularly when targeting swordfish. When attached to the hook and suspended at a certain depth, lightsticks attract baitfish, which may, in turn, attract pelagic predators.

When targeting swordfish, the lines generally are deployed at sunset and hauled at sunrise to take advantage of swordfish nocturnal near-surface feeding habits (NOAA Fisheries, 1999a). In general, longlines targeting tunas are set in the morning, deeper in the water column, and hauled in the evening. Except for vessels of the distant water fleet, which undertake extended trips, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of pelagic species near the surface. The number of hooks per set varies with line configuration and target species (Table 3.5).

Figure 3.17 illustrates the difference between swordfish (shallow) sets and tuna (deep) longline sets. Swordfish sets are buoyed to the surface, have few hooks between floats, and are relatively shallow. This same type of gear arrangement is used for mixed target sets. Tuna sets use a different type of float placed much further apart. Compared with swordfish sets, tuna sets have more hooks between the floats and the hooks are set much deeper in the water column. It is believed that because of the difference in fishing depth, tuna sets hook fewer turtles than the swordfish sets. In addition, tuna sets use bait only, while swordfish fishing uses a combination of bait and lightsticks. Compared with vessels targeting swordfish or mixed species, vessels specifically targeting tuna are typically smaller and fish different grounds.

Regional U.S. Pelagic Longline Fisheries Description

The U.S. pelagic longline fishery sector is comprised of five relatively distinct segments with different fishing practices and strategies, including the Gulf of Mexico yellowfin tuna fishery, the South Atlantic-Florida east coast to Cape Hatteras swordfish fishery, the mid-Atlantic and New England swordfish and bigeye tuna fishery, the U.S. distant water swordfish fishery, and the Caribbean Islands tuna and swordfish fishery. Each vessel type has different range capabilities due to fuel capacity, hold capacity, size, and construction. In addition to geographical area, segments differ by percentage of various target and non-target species, gear characteristics, and deployment techniques. Some vessels fish in more than one fishery segment during the course of the year.

---

[2] As of April 1, 2001, (66 FR 17370) a vessel is considered to have pelagic longline gear on board when a power-operated longline hauler, a mainline, floats capable of supporting the mainline, and leaders (gangions) with hooks are on board.

The Gulf of Mexico Yellowfin Tuna Fishery

Gulf of Mexico vessels primarily target yellowfin tuna year-round; however, each port has one to three vessels that directly target swordfish, either seasonally or year-round. Longline fishing vessels that target yellowfin tuna in the Gulf of Mexico also catch and sell dolphin, swordfish, other tunas, and sharks. During yellowfin tuna fishing, few swordfish are captured incidentally. Many of these vessels participate in other Gulf of Mexico fisheries (targeting shrimp, shark, and snapper/grouper) during allowed seasons. Home ports for this fishery include Madiera Beach, Florida; Panama City, Florida; Dulac, Louisiana; and Venice, Louisiana.

For catching tuna, the longline gear is configured similar to swordfish longline gear but is deployed differently. The gear is typically set out at dawn (between 2 a.m. and noon) and retrieved at sunset (4 p.m. to midnight). The water temperature varies based on the location of fishing. However, yellowfin tuna are targeted in the western Gulf of Mexico during the summer when water temperatures are high. In the past, fishermen have used live bait, however, NMFS prohibited the use of live bait in an effort to decrease bycatch and bycatch mortality of billfish (65 FR 47214, August 1, 2000). In this, and all other areas, except the NED, specific circle hooks (16/0 or larger non-offset and 18/0 or larger with an offset not to exceed 10 degrees) are currently required, as are whole finfish and squid baits.

The South Atlantic ~ Florida East Coast to Cape Hatteras Swordfish Fishery

South Atlantic pelagic longline vessels previously targeted swordfish year-round, although yellowfin tuna and dolphin fish were other important marketable components of the catch. In 2001 (65 FR 47214, August 1, 2000), the Florida East Coast closed area (year-round closure) and the Charleston Bump closed area (February through April closure) became effective. NMFS plans to analyze logbook data to determine the effectiveness of these closed areas (see Sections 2.1 and 3.8 of 2005 SAFE Report; NMFS, 2005).

Prior to these closures, smaller vessels used to fish short trips from the Florida Straits north to the bend in the Gulf Stream off Charleston, South Carolina (Charleston Bump). Mid-sized and larger vessels migrate seasonally on longer trips from the Yucatan Peninsula throughout the West Indies and Caribbean Sea, and some trips range as far north as the mid-Atlantic coast of the United States to target bigeye tuna and swordfish during the late summer and fall. Fishing trips in this fishery average nine sets over 12 days. Home ports (including seasonal ports) for this fishery include Georgetown, South Carolina; Charleston, South Carolina; Fort Pierce, Florida; Pompano Beach, Florida; and Key West, Florida. This sector of the fishery consists of small to mid-size vessels, which typically sell fresh swordfish to local high-quality markets.

The Mid-Atlantic and New England Swordfish and Bigeye Tuna Fishery

Fishing in this area has evolved during recent years to focus almost year-round on directed tuna trips, with substantial numbers of swordfish trips as well. Some vessels participate in directed bigeye/yellowfin tuna fishing during the summer and fall months and then switch to bottom longline and/or shark fishing during the winter when the large coastal shark season is open. Fishing trips in this fishery sector average 12 sets over 18 days. During the season, vessels primarily offload in the ports of New Bedford, Massachusetts; Barnegat Light, New Jersey; Ocean City, Maryland; and Wanchese, North Carolina.

The U.S. Atlantic Distant Water Swordfish Fishery

This fishing ground covers virtually the entire span of the western north Atlantic to as far east as the Azores and the mid-Atlantic Ridge. Approximately 12 large fishing vessels operate out of mid-Atlantic and New England ports during the summer and fall months targeting swordfish and tunas, and then move to Caribbean ports during the winter and spring months. Many of the current distant water operations were among the early participants in the U.S. directed Atlantic commercial swordfish fishery. These larger vessels, with greater ranges and capacities than the coastal fishing vessels, enabled the United States to become a significant player in the north Atlantic fishery. They also fish for swordfish in the south Atlantic. The distant water vessels traditionally have been larger than their southeast counterparts because of the distances required to travel to the fishing grounds. Fishing trips in this fishery tend to be longer than in other fisheries, averaging 30 days and 16 sets. Ports for this fishery range from San Juan, Puerto Rico through Portland, Maine, and include New Bedford, Massachusetts, and Barnegat Light, New Jersey. This segment of the fleet was directly affected by the L-shaped closure in 2000 and the NED closure in 2001. A number of vessels have recently returned to this fishery with the issuance of the July 6, 2004, rule (69 FR 40734) to reduce sea turtle bycatch and bycatch mortality. Unlike in other areas, vessels fishing in the NED are required to use specific circle hooks (18/0 or larger with an offset not to exceed 10 degrees) and whole mackerel and squid baits.

The Caribbean Tuna and Swordfish Fishery

This fleet is similar to the southeast coastal fishing fleet in that both are comprised primarily of smaller vessels that make short trips relatively near-shore, producing high quality fresh product. Both fleets also encounter relatively high numbers of undersized swordfish at certain times of the year. Longline vessels targeting HMS in the Caribbean use fewer hooks per set, on average, fishing deeper in the water column than the distant water fleet off New England, the northeast coastal fleet, and the Gulf of Mexico yellowfin tuna fleet. This fishery is typical of most pelagic fisheries, being truly a multi-species fishery, with swordfish as a substantial portion of the total catch. Yellowfin tuna, dolphin and, to a lesser extent, bigeye tuna, are other important components of the landed catch. Ports for this fishery include St. Croix, U.S. Virgin Islands; and San Juan, Puerto Rico. Many of these high quality fresh fish are sold to local markets to support the tourist trade in the Caribbean.

U.S Pelagic Longline Catch, Landings, and Bycatch

U.S. pelagic longline catch (including bycatch, incidental catch, and target catch) is largely related to these vessel and gear characteristics, but is summarized for the whole fishery in Table 3.6. U.S. pelagic longline landings of Atlantic tunas and swordfish for 1999 – 2003 are summarized in Table 3.6. Additional information related to landings can be seen in Section 3.4.6 of 2005 SAFE Report (NMFS, 2005).

Marine Mammals

Of the marine mammals that are hooked by U.S. pelagic longline fishermen, many are released alive, although some animals suffer serious injuries and may die after being released. Marine mammals are caught primarily during the third and fourth quarters in the Mid-Atlantic Bight and Northeast Coastal areas (Figure 3.17). In 2003, the incidental catch was highest in the third quarter in the Mid-Atlantic Bight.

In 2000, there were 14 observed takes of marine mammals by pelagic longlines. This number has been extrapolated based on reported fishing effort to an estimated 403 mammals fleet-wide (32 common dolphin, 93 Risso's dolphin, 231 pilot whales, 19 whales, 29 pygmy sperm whales) (Yeung, 2001). Incidental catch of pilot whales on pelagic longlines is thought to result from pilot whales preying on tuna that have been caught on the gear.

In 2001 and 2002, there were 16 and 24 observed takes of marine mammals, respectively. The majority of these interactions were observed in the Mid-Atlantic Bight, followed by the NED research experiment. In 2001, a total of 84 Risso's dolphin and 93 pilot whales are estimated to have been interacted with in the pelagic longline fishery. In 2002, the pelagic longline fishery is estimated to have interacted with 87 Risso's dolphin and 114 pilot whales. In the NED research experiment, an additional four Risso's dolphin and one northern bottlenose whale were recorded with serious injuries during 2001, as well as three Risso's dolphin, one unidentified dolphin, and one unidentified marine mammal in 2002. One striped dolphin was recorded as released alive during the NED experiment in 2001, as well as one Risso's dolphin, one common dolphin, one pilot whale, and one unidentified dolphin in 2002 (Garrison, 2003).

In 2003, there were 28 observed takes of marine mammals in the pelagic longline fishery. The majority of these interactions were observed in the Mid-Atlantic Bight, followed by the NED experimental fishery, and the Northeast Coastal area. This number has been extrapolated based on reported fishing effort to an estimated 300 mammals fleet wide (49 beaked whales, 16 dolphin, 30 Atlantic spotted dolphin, 46 common dolphin, 105 Risso's dolphin, 32 pilot whales, 22 minke whales). In addition, five Risso's dolphin, one striped dolphin, and one baleen whale were observed captured in the 2003 NED research experiment, with one Risso's dolphin recorded as dead (Garrison and Richards, 2004).

Sea Turtles

Currently, many sea turtles are taken in the Gulf of Mexico and Northeast Coastal areas (Figure 3.18) and most are released alive. In the past, the bycatch rate was highest in the third and fourth quarters. Loggerhead and leatherback turtles dominate the catch of sea turtles. In general, sea turtle captures are rare, but takes appear to be clustered (Hoey and Moore, 1999).

The estimated take levels for 2000 were 1,256 loggerhead and 769 leatherback sea turtles (Yeung, 2001). For 2001, the estimated take levels outside of the NED closed area were 312 loggerhead and 1,208 leatherback sea turtles. For 2002, the estimated take levels outside of the NED closed area were 575 loggerhead and 962 leatherback sea turtles (Garrison, 2003). In 2003, the estimated take levels outside the NED closed area were 727 loggerhead and 1,112 leatherback sea turtles, with greatest number of takes occurring in the GOM.

As a result of the increased sea turtle interactions in 2001 and 2002, NMFS reinitiated consultation for the pelagic longline fishery and completed a new BiOp on June 1, 2004. The June 2004 BiOp concluded that long-term continued operation of the Atlantic pelagic longline fishery is not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles, but is likely to jeopardize the continued existence of leatherback sea turtles. The BiOp included a reasonable and prudent alternative (RPA) and an incidental take statement (ITS) for the combined years 2004 – 2006, and for each subsequent three-year period (NOAA Fisheries, 2004b).

A final rule published in July 2004 (69 FR 40734) prohibited the possession of "J"-style hooks in the pelagic longline fishery and required the possession and use of specific sea turtle release and disentanglement gears, handling and release protocols, as well as requiring the use of specific circle hooks and baits.

NED Research Experiment

Consistent with the conservation recommendation of an earlier, 2001 BiOp, NMFS initiated a research experiment in the NED area in consultation and cooperation with the domestic pelagic longline fleet. The goal was to develop and evaluate the efficacy of new technologies and changes in fishing practices to reduce sea turtle interactions. In 2001, the experiment attempted to evaluate the effect of gangions placed two gangion lengths from floatlines, the effect of blue-dyed bait on target catch and sea turtle interactions, and the effectiveness of dipnets, line clippers, and dehooking devices. Eight vessels participated, making 186 sets, between August and November. During the course of the research experiment, 142 loggerhead and 77 leatherback sea turtles were incidentally captured and no turtles were released dead.

The data gathered during the 2001 experiment were analyzed to determine if the tested measures reduced the incidental capture of sea turtles by a statistically significant amount. The blue-dyed bait parameter decreased the catch of loggerheads by 9.5 percent and increased the catch of leatherbacks by 45 percent. Neither value is statistically significant. In examining the gangion placement provision, the treatment sections of the gear (with gangions placed 20 fathoms from floatlines) did not display a statistically significant reduction in the number of loggerhead and leatherback sea turtle interactions than the control sections of the gear (with a gangion located under a floatline). The treatment section of the gear recorded an insignificant increase in the number of leatherback interactions. Following an examination of the data, NMFS discovered that the measures had no significant effect upon the catch of sea turtles (Watson *et al.*, 2003).

Dipnets and line clippers were examined for general effectiveness. The dipnets were found to be adequate in boating loggerhead sea turtles. Several line clippers were tested, with the La Force line clipper having the best performance. Several types of dehooking devices were tested, with the work on these devices continuing in the 2002 and 2003 NED research experiment.

In the summer and fall of 2002, NMFS conducted the second year of the research experiment. The use of circle and "J"-hooks, whole mackerel bait, squid bait, and shortened daylight soak time were tested to examine their effectiveness in reducing the capture of sea turtles. The data indicate there were 501 sets made by 13 vessels with 100 percent observer coverage. During the course of the experiment, 100 loggerhead and 158 leatherback sea turtles were captured and 11 were tagged with satellite tags. In addition to the sea turtles, the vessels interacted with one unidentified marine mammal, one unidentified dolphin, one common dolphin, one longfin pilot whale, and four Risso's dolphins; all were released alive (Watson *et al.*, 2003).

In 2003, the research experiment tested a number of treatments to verify the results of the 2002 experiment in addition to testing additional treatments. Data indicate that there were 539 sets made by 11 vessels with 100 percent observer coverage. During the course of the experiment, one olive ridley, 92 loggerhead, and 79 leatherback sea turtles were captured; all were released alive (Foster *et al.*, 2004; Watson *et al.*, 2004). In addition to the sea turtles, the vessels interacted with one striped dolphin, one baleen whale, and five Risso's dolphin resulting in one mortality (Garrison and Richards, 2004).

From 2001 through 2003, NMFS worked with the commercial fishing industry to develop new pelagic longline fishing technology to reduce interaction rates and bycatch mortality of threatened and endangered sea turtles. The cooperative gear technology research investigated line configurations, setting and retrieving procedures, hook types, hook sizes, bait types, and release and disentanglement gears. Ultimately, specific hook designs and bait types were found to be the most effective measures for reducing sea turtle interactions. Large circle hooks and mackerel baits were found to substantially reduce sea turtle interactions over the use of the industry standard "J"-hooks and squid baits. The gears developed to remove hooks and line from hooked and entangled sea turtles are anticipated to reduce post-hooking mortality associated with those interactions not avoided.

NMFS has been promoting and sharing results of the NED experiment in international for a, and believes that adoption of circle hook and bait combinations along with release equipment by international pelagic longline fleets will facilitate conservation of protected sea turtles throughout their ranges.

Seabirds

Gannets, gulls, greater shearwaters, and storm petrels are occasionally hooked by Atlantic pelagic longlines. These species and all other seabirds are protected under the Migratory Bird Treaty Act. Seabird populations are often slow to recover from excess mortality as a consequence of their low reproductive potential (one egg per year and late sexual maturation). According to NMFS observer data from 2003, three unidentified seabirds were observed hooked between January and September. The majority of longline interactions with seabirds occur as the gear is being set. The birds eat the bait and become hooked on the line. The line then sinks and the birds are subsequently drowned.

The United States has developed a National Plan of Action in response to the Food and Agriculture Organization of the United Nations (FAO) International Plan of Action to reduce the incidental take of seabirds (http://www.nmfs.gov.gov/NPOA-S.html). Although Atlantic pelagic longline interactions will be considered in the plan, NMFS has not identified a need to implement gear modifications to reduce seabird takes by Atlantic pelagic longlines. Takes of seabirds have been minimal in the fishery, most likely due to the setting of longlines at night and/or fishing in areas where birds are largely absent. Observed seabird bycatch in the Atlantic pelagic longline fishery from 1999 - 2003 can be seen in Section 3.8 of the 2005 SAFE Report (NMFS, 2005).

Finfish

In the U.S. pelagic longline fishery, fish are discarded for a variety reasons. Swordfish, yellowfin tuna, and bigeye tuna may be discarded because they are undersized or unmarketable (e.g., shark bitten). Blue sharks, as well as other species, are discarded because of a limited markets (resulting in low prices) and perishability of the product. Large coastal sharks are discarded during times when the shark season is closed. Bluefin tuna may be discarded because target catch requirements for other species have not been met. Also, all billfish are required to be released. In the past, swordfish have been discarded when the swordfish season was closed. Reported catch from 1999 – 2003 for the U.S. pelagic longline fishery (including reported bycatch, incidental catch, and target catch) is summarized in Table 3.7. Additional U.S. landings and discard data are available in the 2004 U.S. National Report to ICCAT (NOAA Fisheries, 2004c).

At this time, direct use of observer data with pooling for estimating dead discards in this fishery represents the best scientific information available for use in stock assessments. Direct use of observer data has been employed for a number of years to estimate dead discards in Atlantic and Pacific longline fisheries, including billfish, sharks, and undersized swordfish. Furthermore, the data have been used for scientific analyses by both ICCAT and the Inter-American Tropical Tuna Commission (IATTC) for a number of years.

Bycatch mortality of marlins, swordfish, and bluefin tuna from all fishing nations may significantly reduce the ability of these populations to rebuild, and it remains an important management issue. In order to minimize bycatch and bycatch mortality in the domestic pelagic longline fishery, NMFS implemented regulations to close areas to longline fishing and has banned the use of live bait by longline vessels in the Gulf of Mexico. For additional information see Section 3.4.1 in the 2005 SAFE Report (NMFS, 2005).

As part of the BFT rebuilding program, ICCAT recommends an allowance for dead discards. The U.S. annual dead discard allowance is 68 mt ww. The estimate for the 2003 calendar year was used as a proxy to calculate the amount to be added to, or subtracted from, the U.S. BFT landings quota for 2004. The 2003 calendar year preliminary estimate of U.S. dead discards, as reported per the longline discards calculated from logbook tallies, adjusted as warranted when observer counts in quarterly/geographic stratum exceeded logbook reports, totaled 52.4 mt ww. Estimates of dead discards from other gear types and fishing sectors that do not use the pelagic longline vessel logbook are unavailable at this time, and thus, are not included in this calculation. As U.S. fishing activity is estimated to have resulted in fewer dead discards than its allowance, the ICCAT recommendation and U.S. regulations state that the United States may add one half of the difference between the amount of dead discards and the allowance (i.e., 68.0 mt – 52.4 mt = 15.6 mt, 15.6 mt/2 = 7.8 mt ww) to its total allowed landings for the following fishing year, to individual fishing categories, or to the Reserve category. NMFS proposes to allocate the 7.8 mt ww to the Reserve category quota to assist in covering potential overharvests from the previous fishing years.

The 2002 calendar year preliminary dead discard estimate, as reported in pelagic longline vessel logbooks and published in 2003 Final Initial Quota Specifications (68 FR 56783, October 2, 2003), totaled 38.0 mt ww. This preliminary estimate has been revised using the longline discards calculated from logbook tallies, adjusted as warranted when observer counts in stratum exceeded logbook reports. The revised 2002 calendar year dead discard estimate is 41.6 mt ww.

3.2.1.2 *International Aspects of the Atlantic Pelagic Longline Fishery*

Pelagic longline fisheries for Atlantic HMS primarily target swordfish and tunas. Directed pelagic longline fisheries in the Atlantic have been operated by Spain, the United States, and Canada since the late 1950s or early 1960s. The Japanese pelagic longline tuna fishery started in 1956 and has operated throughout the Atlantic since then. Most of the 35 other ICCAT nations now also operate pelagic longline vessels.

ICCAT generally establishes management recommendations on a species (*e.g.* swordfish) or issue basis (*e.g.* data collection) rather than by gear type. For example, ICCAT typically establishes quotas or landing limits by species, not gear type. In terms of data collection, ICCAT may require use of specific collection protocols or specific observer coverage levels in certain fisheries or on vessels of a certain size, but these are usually applicable to all gears, and not specific to any one gear type. However, there are a handful of management recommendations that are specifically applicable to the international pelagic longline fishery. These include, a prohibition on longlining in the

Mediterranean Sea in June and July by vessels over 24 meters in length, a prohibition on pelagic longline fishing for bluefin tuna in the Gulf of Mexico, and mandated reductions in Atlantic white and blue marlin landings for pelagic longline and purse seine vessels from specified levels, among others.

Because most ICCAT management recommendations pertain to individual species or issues, as discussed above, it is often difficult to obtain information specific to the international pelagic longline fishery. For example, a discussion of authorized total allowable catches (TAC) for specific species in this section of the document would be of limited utility because it is not possible to identify what percentage of quotas are allocated to pelagic longline. Division of quota by gear type is typically done by individual countries.

Nevertheless, ICCAT does report landings by gear type. Available data indicate that longline effort produces the second highest volume of catch and effort, and is the most broadly distributed (longitudinally and latitudinally) of the gears used to target ICCAT managed species (Figure 3.19) (SCRS, 2004). Purse seines produce the highest volume of catch of ICCAT managed species from the Atlantic (SCRS, 2004). From 1999 through 2002 (inclusive) there was a declining trend in estimated international landings of HMS for fisheries in which the U.S. participated. In 2003, international landings of HMS for fisheries in which the U.S. participated totaled 113,826 mt, which represented a modest increase over 2002 (SCRS, 2004). Detailed information on international Atlantic pelagic longline catches can be found in Table 3.8.

Scientific observer data are being collected on a range of pelagic longline fleets in the Atlantic and will be increasingly useful in better quantifying total catch, catch composition, and disposition of catch as these observer programs mature. Previous ICCAT observer coverage requirements of five percent for non-purse seine vessels that participated in the bigeye and yellowfin tuna fishery, including pelagic longline (per ICCAT Recommendation 96-01), are no longer in force. There is currently no ICCAT required minimum level of observer coverage specific to pelagic longline fishing. Japan is required to have eight percent observer coverage of its vessels fishing for swordfish in the North Atlantic, which are primarily pelagic longline vessels, however, the recommendation is not specific to vessel or gear type. ICCAT recommendation 04-01, a conservation and management recommendation for the bigeye tuna fishery, will enter into force in mid-2005 and requires at least five percent observer coverage of pelagic longline vessels over 24 meters fishing for bigeye.

ICCAT has also developed a running tabulation of the diversity of species caught by the various gears used to target tunas and tuna like species in the Atlantic and Mediterranean (Table 3.9). For all fish species, longline gear shows the highest documented diversity of catch, followed by gillnets and purse seine. For seabirds, longline gear again shows the highest diversity of catch, while for sea turtles and marine mammals, purse seine and gillnet have a higher documented diversity of species for Atlantic tuna fleets (SCRS, 2004).

3.2.1.3 *U.S. Pelagic Longline Catch in Relation to International Catch*

Highly Migratory Species

The U.S. fleet is a small part of the international fleet that competes on the high seas for catches of tunas and swordfish (Table 3.8). Although the U.S. fleet landed as much as 35 percent of the swordfish from the North Atlantic, north of 5^{o} N. latitude in 1990, this proportion decreased to 24.3 percent by 2001. For tunas, the U.S. proportion of landings was 23 percent in 1990, decreasing to 9.4 percent of total Atlantic tuna catches by 2001 (NOAA Fisheries, 2003a). In 2002, the U.S fleet landed 27.6 percent of the swordfish from the North Atlantic, and 11.5 percent of total Atlantic tuna catches (NOAA Fisheries, 2004a). In recent years, the proportion of U.S. pelagic longline landings of HMS, for the fisheries in which the United States participates, has remained relatively stable in proportion to international landings (Table 3.8). The U.S. fleet accounts for less than 0.5 percent of the landings of swordfish and tuna from the Atlantic Ocean south of 5^{o} N. latitude, and does not operate at all in the Mediterranean Sea. Tuna and swordfish landings by foreign fleets operating in the tropical Atlantic and Mediterranean are greater than the catches from the north Atlantic area where the U.S. fleet operates. Even within the area where the U.S. fleet operates, the U.S. portion of fishing effort (in numbers of hooks fished) is less than 10 percent of the entire international fleet's effort, and likely less than that due to differences in reporting effort between ICCAT countries (NOAA Fisheries, 2001).

Sea Turtles

From 1999 to 2003, the U.S. pelagic longline fleet targeting HMS captured an average of 772 loggerhead and 1,013 leatherback sea turtles per year, based on observed takes and total reported effort. In 2003, the U.S. Pelagic longline fleet was estimated to have captured 727 loggerhead and 1,112 leatherback sea turtles (Garrison and Richards, 2004). Since other ICCAT nations do not monitor incidental catches of sea turtles, an exact assessment of their impact is not possible. However, high absolute numbers of sea turtle catches in the foreign fleets have been reported from other sources (NOAA Fisheries, 2001). Throughout the Atlantic basin, including the Mediterranean Sea, a total of 210,000 – 280,000 loggerhead and 30,250 – 70,000 leatherback sea turtles are estimated to be captured by pelagic longline fisheries each year (Lewiston *et al*., 2004).

Mortality in the domestic and foreign pelagic longline fisheries is just one of numerous factors affecting sea turtle populations in the Atlantic (National Research Council, 1990). Many sources of anthropogenic mortality are outside of U.S. jurisdiction and control. If the U.S. swordfish quota was to be relinquished to other fishing nations, the effort now expended by the U.S. fleet would likely be replaced by foreign effort. This could significantly alter the U.S. position at ICCAT and make the implementation of international conservation efforts more difficult. This would also eliminate the option of gear or other experimentation with the U.S. longline fleet, thus making it difficult to find take reduction solutions which could be transferred to other longlining nations to effect a greater global reduction in sea turtle takes in pelagic longline fisheries. The United

States has, and will continue to make efforts at ICCAT, IATTC, and other international forums, to encourage adoption of sea turtle conservation measures by international fishing fleets. However, NMFS is not aware of the implementation of sea turtle conservation measures by foreign fleets, and in the absence of a domestic fishing fleet subject to sea turtle conservation measures, foreign vessels would likely increase their fishing effort and sea turtle mortality would likely increase. Further, NMFS continues to advance turtle conservation through participation in both domestic and international workshops.

In February 2003, the United States supported a workshop consisting of technical experts on sea turtle biology and longline fishery operations from interested nations in order to share information and discuss possible solutions to reduce incidental capture of marine turtles in these fisheries. The United States introduced the NED sea turtle bycatch mitigation research at the November 2003, ICCAT meeting in Dublin, Ireland, and co-sponsored ICCAT Resolution 03-11 which encouraged other nations to improve data collection and reporting on sea turtle bycatch and promote the safe handling and release of incidentally captured sea turtles. A poster and video describing the NED research experiment and preliminary results were displayed, as well as many of the experimentally tested release gears. In January 2004, the Northeast Distant Waters Longline Research ad hoc advisory group met in Miami, Florida. The purpose of this meeting was to present a summary of the 2001 and 2002 NED pelagic longline sea turtle bycatch mitigation research and the preliminary results for the 2003 research, and to discuss future research needs. Also in January 2004, the IATTC - CIAT Bycatch Working Group met in Kobe, Japan. The purpose of U.S. attendance at this meeting was to present results of sea turtle mitigation research by the U.S, to hear research results on bycatch mitigation from other countries, to encourage IATTC countries to evaluate or adopt sea turtle mitigation technology in their fisheries, and to address other bycatch issues in longline fisheries.

Additionally, the Inter-American Convention for the Protection and Conservation of Sea Turtles ("Inter-American Convention") was concluded on September 5, 1996, in Salvador, Brazil, and entered into force in May 2001. This is the first international agreement devoted solely to the protection of sea turtles. The Inter-American Convention calls for the Parties to establish national sea turtle conservation programs. Each party will agree to implement broad measures for the conservation of sea turtles, including the use of turtle excluder devices in commercial shrimp trawl vessels and the mitigation of impacts on sea turtles from other fisheries.

3.2.1.4 *Management of the U.S. Pelagic Longline Fishery*

The U.S. Atlantic pelagic longline fishery is restricted by a limited swordfish quota, divided between the North and South Atlantic (separated at 5° N. lat.). Other regulations include minimum sizes for swordfish, yellowfin, bigeye, and bluefin tuna, limited access permitting, bluefin tuna catch requirements, shark quotas, protected species incidental take limits, reporting requirements (including logbooks), and gear and bait requirements. Current billfish regulations prohibit the retention of billfish by commercial vessels, or the sale of billfish from the Atlantic Ocean. As a result, all billfish hooked on longlines must be discarded, and are considered bycatch. This is a heavily managed gear type and, as such, is strictly monitored. Because it is difficult for pelagic longline fishermen to avoid undersized fish in some areas, NMFS has closed areas in the Gulf of Mexico and along the east coast. The intent of these closures is to relocate some of the fishing effort into areas where bycatch is expected to be lower. There are also time/area closures for pelagic longline fishermen designed to reduce the incidental catch of bluefin tuna and sea turtles. In order to enforce time/area closures and to monitor the fishery, NMFS requires all pelagic longline vessels to report positions on an approved vessel monitoring system (VMS).

In June 2004, NMFS conditionally re-opened the NED to pelagic longline fishing. NMFS limited vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole mackerel and squid baits may be possessed and or utilized with allowable hooks. In August of 2004, NMFS limited vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. All pelagic longline vessels must possess and use sea turtle handling and release gear in compliance with NMFS careful release protocols.

Permits

The 1999 Tunas, Swordfish, and Shark FMP established six different limited access permit types: 1) directed swordfish, 2) incidental swordfish, 3) swordfish handgear, 4) directed shark, 5) incidental shark, and 6) tuna longline. To reduce bycatch concerns in the pelagic longline fishery, these permits were designed so that the swordfish directed and incidental permits are valid only if the permit holder also holds both a tuna longline and a shark permit. Similarly, the tuna longline permit is valid only if the permit holder also holds both a swordfish (directed or incidental, not handgear) and a shark permit.

As of October 2004, approximately 208 tuna longline limited access permits had been issued. In addition, approximately 195 directed swordfish limited access permits, 99 incidental swordfish limited access permits, 241 directed shark limited access permits, and 348 incidental shark limited access permits had been issued. Vessels with limited access swordfish and shark permits do not necessarily use pelagic longline gear, but these are the only permits that allow for the use of pelagic longline gear.

Monitoring and Reporting

Pelagic longline fishermen and the dealers who purchase HMS from them are subject to reporting requirements. NMFS has extended dealer reporting requirements to all swordfish importers as well as dealers who buy domestic swordfish from the Atlantic. These data are used to evaluate the impacts of harvesting on the stock and the impacts of regulations on affected entities.

Commercial HMS fisheries are monitored through a combination of vessel logbooks, dealer reports, port sampling, cooperative agreements with states, and scientific observer coverage. Logbooks contain information on fishing vessel activity, including dates of trips, number of sets, area fished, number of fish, and other marine species caught, released and retained. In some cases, social and economic data such as volume and cost of fishing inputs are also required.

Pelagic Longline Observer Program

One thousand eighty-eight pelagic longline sets were observed and recorded by NMFS observers in 2003 (11.5% overall coverage - 100% coverage in the NED; and 6.2% coverage in remaining areas). Table 3.10 details the amount of observer coverage in past years for this fleet. The June 1, 2004, BiOp mandates that eight percent of the pelagic longline trips be selected for observer coverage. Generally, due to logistical problems, it has not always been possible to place observers on all selected trips. NMFS is working towards improving compliance with observer requirements and facilitating communication between vessel operators and observer program coordinators. In addition, fishermen are reminded of the safety requirements for the placement of observers specified at 50 CFR 600.746, and the need to have all safety equipment on board required by the U.S. Coast Guard.

Safety Issues Associated with the Fishery

Like all offshore fisheries, pelagic longlining can be dangerous. Trips are often long, the work is arduous, and the nature of setting and hauling longline gear may result in injury or death. Like all other HMS fisheries, longline fishermen are exposed to unpredictable weather. NMFS does not wish to exacerbate unsafe conditions through the implementation of regulations. Therefore, NMFS considers safety factors when implementing management measures on pelagic longline fishermen. For example, all time/area closures are expected to be closed to fishing, not transiting, in order to allow fishermen to make a direct route to and from fishing grounds. NMFS seeks comments from fishermen on any safety concerns they may have. Fishermen have pointed out that, due to decreasing profit margins, they may fish with less crew or less experienced crew or may not have the time or money to complete necessary maintenance tasks. NMFS encourages fishermen to be responsible in fishing and maintenance activities.

3.2.1.5 *Economic Aspects of the U.S. Pelagic Longline Fishery*

Costs and Revenues

The amount of economic data available for this gear type is increasing, although additional up to date information is needed. Since 1996, NMFS has been collecting economic information on a per trip basis through submission of voluntary forms in the pelagic logbook maintained in the Southeast Fisheries Science Center (SEFSC). Compared to the number of logbook reports, few economic data were collected, because submission was voluntary. In 2003, NMFS initiated mandatory cost earnings reporting for selected vessels in order to improve the economic data available for all HMS fisheries. Mandatory submission of this economic data is needed for NMFS to accurately assess the economic impacts of proposed fishery management regulations on fishermen and their communities as required by Federal laws, such as the National Environmental Policy Act (NEPA), Executive Order 12866, the Regulatory Flexibility Act (RFA), and National Standards 7 and 8 of the Magnuson-Stevens Act. Specifically, this information will be used to conduct cost-benefit analyses and develop regulatory impact analyses of proposed regulations in an effort to help NMFS develop and improve fishery management strategies.

Larkin *et al.* (2000) examined 1996 logbooks and the 1996 voluntary forms and found that net returns to a vessel owner varied substantially depending on the vessel size and the fishing behavior (i.e. sets per trip, fishing location, season, target species). This study noted that of 3,255 pelagic longline trips which reported, 642 provided the voluntary economic information. From all trips, four species (swordfish, yellowfin tuna, dolphin fish, and sandbar sharks) comprised 77 percent of all species landed and accounted for 84 percent of the total gross revenues for the fleet. Generally, vessels that were between 46 and 64 feet in length, had between 10 and 21 sets per trip, fished in the second quarter, fished in the Caribbean, or had more than 75 percent of their gross revenues from swordfish had the highest net return to the owner (ranging from $3,187 to $13,097 per trip). Vessels that were less than 45 feet in length, had between one and three sets per trip, fished in the first quarter, fished between North Carolina and Miami, FL, or had between 25 and 50 percent of their gross revenues from swordfish had the lowest net return to the owner (ranging from $642 to $1,885 per trip).

Larkin *et al*. (in press) used the above data in a cost function model to determine if and how captains decide on levels of effort in order to minimize variable costs per trip. They found that, on average, increasing the price of bait increased the demand for light sticks (i.e. these inputs are complements); changing the price of fuel did not affect any purchase decisions; and for every additional 10 feet in vessel length, operators demanded an additional 149 light sticks, 319 pounds of bait, and 540 gallons of fuel per trip. They also found that on average increasing swordfish landings required additional light sticks, bait and fuel. Increasing tuna landings reduced the demand for light sticks while increasing the demand for bait and fuel. Additionally, some inputs (i.e. light sticks, bait demand, and fuel demand) varied significantly with region, quarter, number of sets, and target species. They also found that if the price of light sticks or bait increases, the quantity demanded falls, particularly for light sticks (i.e. own-price elasticities are negative). However, elasticities could also change depending on region, target species, or number of trips but did not change between seasons.

Porter *et al*. (2001) conducted a survey of 147 vessels along the Atlantic and Gulf of Mexico (110 surveys were completed) in 1998 regarding 1997 operations. The survey consisted of 55 questions divided into five categories (vessel characteristics, fishing and targeting strategies, demographics, comments about regulations, and economic information of variable and fixed costs). The vessels interviewed were diverse in vessel size and target species (swordfish, tuna, mixed). Information was also used from trip tickets and logbooks. They found that on average, the average vessel received approximately $250,000 annual gross revenues, annual variable costs were approximately $190,000, and annual fixed costs were approximately $50,000. Thus, vessels were left with approximately $8,000 to cover depreciation on the vessel and the vessel owner lost approximately $3,500 per year. On a per trip level, gross revenues averaged $22,000 and trip expenses, including labor, were $16,000. Labor cost the owner the most (43 percent) followed by gear. Generally trip returns were divided so the vessel owner received 43 percent and the captain and crew 57 percent. Based on 2002 data, NMFS estimates annual gross revenues of approximately $187,074.00 in 2002 (NOAA Fisheries, 2004d). Along with other studies, Porter *et al*. (2001) noted differences between region, vessel size, and target species. Porter *et al*. (2001) also noted that 1997 was probably a financially poor year due to a reduction in swordfish quota and a subsequent closure of the fishery. In all, these studies are consistent with Larkin *et al*. (1998) and Ward and Hanson (1999) in that characteristics of fishing trips can influence the success of the trip and that pelagic longline fishermen do not have large profits.

Many consumers consider swordfish to be a premier seafood product. Swordfish that bring $3.00 per pound to the vessel may sell in some restaurants at prices of over $20.00 for a six-ounce steak. Swordfish prices are affected by a number of demand and supply factors, including the method of harvest, either by distant-water or inshore vessels, and by gear type (harpoon vs. pelagic longline). Generally, prices for fresh swordfish can be expected to vary during the month due to the heavier fishing effort around the full moon. Swordfish prices also vary by size and quality, with prices first increasing with size, up to about 250 pounds dressed weight (lbs dw), then decreasing due to higher handling costs for larger fish. "Marker" swordfish weighing 100 to 275 lbs dw are preferred by restaurants because uniform-sized dinner portions can be cut with a minimum of waste. "Pups" weighing 50 to 99 lbs dw are less expensive than markers but the yield of uniformly sized portions is smaller. "Rats" (33 to 49 lbs dw) are the least expensive but are generally not used by food service or retail buyers who require large portions of uniform size. Similarly, larger tunas are also more desirable than smaller ones. Size of fish harvested can be a substantial factor in management because regulations might have the effect of reducing catch but might raise the average size per fish caught and therefore, raise the price. Current ex-vessel prices for Atlantic HMS are summarized in Section 3.5 of 2005 SAFE Report (NMFS, 2005).

3.3 HABITAT

3.3.1 Regulatory Requirements

Section 303(a)(7) of the Magnuson-Stevens Act, 16 U.S.C. §§ 1801 *et seq*., as amended by the Sustainable Fisheries Act in 1996, requires that FMP's describe and identify essential fish habitat (EFH), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." (16 U.S.C. § 1802 (10)). The EFH regulations (at 50 C.F.R. 600 Subpart J) provide additional interpretation of the definition of essential fish habitat: "'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle."

The EFH regulations require that EFH be described and identified within the U.S. Exclusive Economic Zone (EEZ) for all life stages of each species in a fishery management unit. FMP's must describe EFH in text, tables, and figures, as appropriate, that provide information on the biological requirements for each life history stage of the species. According to the EFH regulations, an initial inventory of available environmental and fisheries data sources should be undertaken to compile information necessary to describe and identify EFH and to identify major species-specific habitat data gaps. Available information should be evaluated through a hierarchical analysis based on: distribution data for some or all portions of the geographic range of a species (Level 1); habitat-related densities or relative abundances (Level 2); growth, reproduction, or survival rate comparisons between habitats (Level 3); and habitat-dependent production rates (Level 4). This information should be interpreted with a risk-averse approach to ensure that adequate areas are protected as EFH for the managed species. Habitats that satisfy the criteria in the Magnuson-Stevens Act have been identified and described as EFH in the 1999 FMP's and in Amendment 1 to the 1999 Tunas, Swordfish, and Shark FMP (NOAA Fisheries, 1999a; 2003b).

NMFS originally described and identified EFH and related EFH regulatory elements for all HMS in the management unit in the 1999 FMP's, and more recently updated EFH for five shark species (blacktip, dusky, finetooth, nurse, and sandbar) in Amendment 1 to the 1999 Tunas, Swordfish, and Shark FMP, which was implemented in 2003. The EFH regulations further require NMFS to conduct a comprehensive review of all EFH related information at least once every five years and revise or amend the EFH provisions if warranted. This includes modifying the boundaries of areas considered to be EFH. To that effect, NMFS is currently undertaking the comprehensive five-year review of information pertaining to EFH for all HMS in the management unit.

NMFS is currently conducting a review of the most recent life history and EFH related information available for HMS in the management unit, with an emphasis on the factors that influence distribution of the species. This includes information available in the form of fishery-independent sources (directed research investigations) fishery-dependent sources (capture and bycatch reporting), and fishery observer data. For more information on identifying EFH see Section 2.2 in the 2005 Pre-Draft of the Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2005).

3.3.1.1 *Habitat Areas of Particular Concern*

The EFH regulations encourage FMP's and FMP amendments to identify habitat areas of particular concern (HAPCs) within EFH, for habitats that satisfy one or more of the criteria of being sensitive or vulnerable to environmental stresses, are rare, or are particularly important ecologically to the species. HAPCs represent subsets of identified EFH areas based upon the importance of their ecological function, their sensitivity to human-induced environmental degradation, development activities that serve as stressors on the habitat, and the rarity of the habitat. These areas should be identified to provide additional focus for conservation efforts.

Because of the lack of specific, detailed information regarding HMS habitat associations, the 1999 FMP's and Amendment 1 to the 1999 Tunas, Swordfish, and Shark FMP identified HAPC for only one HMS. The HAPC areas identified were for sandbar shark nursery and pupping grounds in Great Bay, NJ, lower and middle Delaware Bay, lower Chesapeake Bay, MD, and near the Outer Banks, NC, in areas of Pamlico Sound and off Hatteras and Ocracoke Islands. It is possible that the comprehensive five year review of new EFH related information may result in the identification of HAPCs for additional HMS species. For more information on identifying HAPCs see Section 2.2 in the 2005 Pre-Draft of the Atlantic Highly Migratory Species Fishery Management Plan.

3.3.1.2 *Research and Information Needs*

The EFH regulations suggest that FMP's and FMP amendments should contain recommendations, preferably in priority order, for research efforts that have been identified as necessary for carrying out the EFH management mandate. The 1999 FMP contains numerous recommendations for data needs, and many of these are being addressed through ongoing research efforts and data collection. These efforts vary from the gathering of additional information from diverse sources in order to better map the distributions of EFH, to long-range research projects that will provide additional life history information for use in better defining the environmental parameters that influence the distribution of the HMS. For example, the highest priority recommendation was to continue the delineation of shark nurseries and establish geographic boundaries of the summer nurseries of commercially important species. To address this, in 2002, NOAA scientists, including the NEFSC, completed a research synthesis project to delineate shark nursery areas along the Atlantic East coast and in the Gulf of Mexico (McCandless *et al*., 2004). The results of the comprehensive five year review should also result in an updated identification of research and information needs that should be addressed in order to improve the ability to conserve and manage habitat concerns under the EFH mandate. Updates on some of the research can be found in Section 3.3 of 2005 SAFE Report (NMFS, 2005).

3.3.2 Habitat Types and Distributions

HMS traverse large expanses of the world's oceans, straddling jurisdictional boundaries. Although many of the species frequent other oceans of the world, the Magnuson-Stevens Act only authorizes the description and identification of EFH in Federal, state or territorial waters, including areas of the U.S. Caribbean, the Gulf of Mexico and the Atlantic coast of the United States to the seaward limit of the U.S. EEZ. These areas are connected by currents and water patterns that influence the occurrence of HMS at particular times of the year. On the largest scale, the North and South Equatorial currents bathe the U.S. Caribbean islands. The North Equatorial Current continues through the Caribbean Basin to enter the Gulf of Mexico through the Yucatan Straits. The current continues through the Florida Straits to join the other water masses (including the Antilles Current) to form the Gulf Stream along the eastern coast of the United States. Variations in flow capacities of the Florida Straits and the Yucatan Straits produce the Loop Current, the major hydrographic feature of the Gulf of Mexico. These water movements in large part influence the distributions of the pelagic life stages of HMS.

Tuna, swordfish, and billfish distributions are most frequently associated with hydrographic features such as density fronts between different water masses. The scales of these features vary. For example, the river plume of the Mississippi River extends for miles into the Gulf of Mexico and is a fairly predictable feature, depending on the season. Fronts that set up over the DeSoto Canyon in the Gulf of Mexico, or over the Charleston Bump or the Baltimore Canyon in the Mid-Atlantic, may be of a much smaller scale. The locations of many fronts or frontal features are statistically consistent within broad geographic boundaries. These locations are influenced by riverine inputs, movement of water masses, and the presence of topographic structures underlying the water column, thereby influencing the habitat of HMS. Those areas that are known spawning grounds, or areas of aggregation for feeding or other reasons, are considered to be EFH for those species.

Sharks are found in a wide variety of coastal and ocean habitats including estuaries, nearshore areas, the continental shelf, continental slope, and open ocean. Many species are migratory and, like all other marine species, are affected by the condition of the habitat. Atlantic sharks are broadly distributed as adults but have been found to utilize specific estuaries as pupping and nursery areas during pupping season and throughout their neonate (newborn) life stages which may vary from a few to many months. Since coastal and coastal pelagic species frequently appear near shore and have pupping and nursery areas near shore, much more is known about their habitat requirements, particularly for early life history stages. Much less is known about the habitat requirements, pupping areas, and other details of pelagic and deep dwelling species.

The following sections are intended to provide a general overview of the various habitats with which HMS are most frequently associated. A more detailed description is contained in the 1999 Tunas, Swordfish, and Shark FMP (NOAA Fisheries, 1999a).

3.3.2.1 *Atlantic Ocean*

Material in this section is largely a summary of information in MMS (1992) and MMS (1996). Original sources of information are referenced in those documents.

The region of the Atlantic Ocean within which EFH for Federally managed HMS is identified spans the area between the Canadian border in the north and the Dry Tortugas in the south. It includes a diverse spectrum of aquatic species of commercial, recreational, and ecological importance. The distribution of marine species along the Atlantic seaboard is strongly affected by the cold Labrador Current in the northern part, the warm Gulf Stream in the middle and southern portions of the region, and generally by the combination of high summer and low winter temperatures. For many species Cape Hatteras forms a strong zoogeographic boundary between the Mid- and South Atlantic areas, while the Cape Cod/Nantucket Island area is a somewhat weaker zoogeographic boundary in the north.

Coastal and Estuarine Habitat

Although HMS move primarily through open ocean waters, they do periodically utilize inshore habitats. This is especially true for several species of sharks that move inshore, often into shallow coastal waters and estuaries, to give birth; these areas then become nursery areas as the young develop. Examples include Great Bay, New Jersey, Chesapeake Bay, Maryland and Delaware Bay, Delaware, which provide important nursery habitat for sandbar sharks, and Bull's Bay, South Carolina, and Terrebone Bay, Louisiana, which are important blacktip shark nursery areas. Typically, the pups (neonates) remain in these same areas throughout their early life stages, which may vary from a few to many months. Recent tagging studies have shown that some sharks return to summer nursery areas in subsequent years. Although billfish move primarily throughout open-ocean waters, two species, the white marlin and the sailfish can be found inshore. Sailfish are also known to move inshore to spawn off the east coast of Florida and in the Florida Keys.

Coastal habitats that may be encountered by HMS are described in this section. Those areas that are known nursery or spawning grounds, or areas of HMS aggregation for feeding or other reasons, are considered to be EFH for those species. It should be noted that characteristics of coastal and offshore habitats might be affected by activities and conditions occurring outside of those areas (farther up-current) due to water flow or current patterns that may transport materials that could cause negative impacts.

Estuaries are highly productive, yet fragile, environments that support a great diversity of fish and wildlife species, including sharks. Many commercially valuable fish and shellfish stocks are dependent on these areas during some stage of their development. In the vicinity of North Carolina, Virginia, and Maryland, approximately 90 percent of the commercially valuable fish species are dependent on estuaries for at least part of their life cycle.

Along the Atlantic seaboard coastal wetlands are located predominantly south of New York because these coastal areas have not been glaciated. Nearly 75 percent of the Atlantic coast salt marshes are found in the states of North Carolina, South Carolina, and Georgia. These three states contain approximately nine million acres of salt marsh. Wetland vegetation plays an important role in nutrient cycling, and provides stability to coastal habitats by preventing the erosion of sediments and by absorbing the energy of storms.

There are 13,900 square miles (sq mi) (36,000 square kilometers [sq km]) of estuarine habitat along the Atlantic coast, of which approximately 68 percent (9,400 sq mi) occurs north of the Virginia/ North Carolina border, with Chesapeake Bay contributing significantly to the total. South of the Gulf of Maine, where there is a wider coastal plain and greater agricultural activity, estuaries carry higher sediment and nutrient loads. The increased fertility and generally higher water temperatures resulting from these nutrient loads allow these estuaries to support greater numbers of fish and other aquatic organisms.

South of the Virginia/North Carolina border, there are approximately 4,500 sq mi (11,655 sq km) of estuarine habitat. The Currituck, Albemarle, and Pamlico Sounds, which together constitute the largest estuarine system along the entire Atlantic coast, make up a large portion of these southern estuaries. A unique feature of these sounds is that they are partially enclosed and protected by a chain of fringing islands, the Outer Banks, located 32 to 48 km (20 to 30 mi) from the mainland.

Because of their low tidal flushing rates, estuaries are generally more susceptible to pollution than other coastal water bodies. The severity of the problem varies depending on the extent of tidal flushing. In Maryland and Virginia, the primary problems reported are excessive nutrients (nitrates and phosphates), particularly in the Chesapeake Bay and adjoining estuarine areas. Other problems included elevated bacterial and suspended sediment levels. Non-point sources of pollution are considered one of the main causes of pollution. Elevated bacterial levels were also listed as a local coastal pollution problem in Maryland.

In North Carolina, the primary problems listed for estuarine areas were enrichment in organics and nutrients, fecal coliform bacteria, and low dissolved oxygen. Insufficient sewage treatment, widespread use of septic systems in coastal areas, as well as agricultural runoff are considered to be major causes of these pollution problems. Oil spills from vessel collisions and groundings, as well as illegal dumping of waste oil, are a common cause of local, short-term water quality problems, especially in estuaries along the North and Mid-Atlantic coasts. These sources of pollution and habitat degradation may have a negative impact on coastal shark populations, particularly during vulnerable early life stages.

Many of the coastal bays and estuaries along the Atlantic East Coast and Gulf of Mexico are described in greater detail in the 1999 Tunas, Swordfish, and Shark FMP, including the distribution, size, depth, freshwater inflow, habitat types, tidal range and salinity for each of the major estuaries and bays on the East coast and Gulf coast, and are not repeated here.

Continental Shelf and Slope Areas

Moving seaward away from the coast, the next major geologic features encountered are the continental shelf and slope areas. The continental shelf is characterized by depths ranging from a few meters to approximately 60 meters (m) (198 ft), with a variety of bottom habitat types. Far less research has been done in this area than on the coasts and estuaries, and consequently much less is known about the specific habitat requirements of HMS within these regions.

The shelf area of the Mid-Atlantic Bight averages about 100 km (60 mi) in width, reaching a maximum of 150 km (90 mi) near Georges Bank, off New England, and a minimum of 50 km (30 mi) offshore Cape Hatteras, NC. Current speeds are strongest at the narrowest part of the shelf where wind-driven current variability is highest. The distribution of marine species, including HMS, along the Atlantic seaboard may be strongly influenced by currents, the warm Gulf Stream in the middle and south portions of the region, and generally by the combination of high summer and low winter temperatures.

The continental shelf in the South Atlantic Bight varies in width from 50 km (32 mi) off Cape Canaveral, FL to a maximum of 120 km (75 mi) off Savannah, GA, and a minimum of 30 km (19 mi) off Cape Hatteras. The shelf is divided into three cross-shelf zones. Waters on the inner shelf (0 to 20 m [0 to 66 ft]) interact extensively with rivers, coastal sounds, and estuaries. This interaction tends to form a band of low-salinity, stratified water near the coast that responds quickly to local wind-forcing and seasonal atmospheric changes. Mid-shelf (20 to 40 m [66 to 132 ft]) current flow is strongly influenced by local wind events with frequencies of two days to two weeks. In this region, vertically well mixed conditions in fall and winter contrast with vertically stratified conditions in the spring and summer. Gulf Stream frontal disturbances (e.g., meanders and cyclonic cold core rings) that occur on time scales of two days to two weeks dominate currents on the outer shelf (40 to 60 m [132 to 197 ft]).

The Mid-Atlantic area from Cape Cod, MA to Cape Hatteras, NC represents a transition zone between northern cold-temperate waters of the north and the warm-temperate waters to the south. Water temperatures in the Mid-Atlantic vary greatly by season. Consequently, many of the fish species of importance in the Mid-Atlantic area migrate seasonally, whereas the major species in the other three areas are typically resident throughout the year (MMS, 1992; 1996). The shelf-edge habitat may range in water depth between 40 and 100 m (131 and 328 ft). The bottom topography varies from smooth sand to mud to areas of high relief with associated corals and sponges. The fish species found in this area include parrotfish (*Scaridae*) and the deepwater species of the snapper-grouper assemblage.

The continental slope generally has smooth mud bottoms in water depths of 100 to 200 m (328 to 656 ft). Many of the species in this zone are representatives of cold-water northern species exhibiting tropical submergence (i.e., being located in deeper, cooler water as latitude decreases).

A topographic irregularity southeast of Charleston, SC, known as the Charleston Bump, is an area of productive sea floor, which rises abruptly from 700 to 300 m (2,300 to 980 ft) within a distance of about 20 km (12 mi), and at an angle, which is approximately transverse to both the general isobath pattern and the Gulf Stream currents. The Charleston Gyre is a persistent oceanographic feature that forms in the lee of the Charleston Bump. It is a location in which larval swordfish have been commonly found and may serve as nursery habitat.

Pelagic Environment

Many HMS spend their entire lives in the pelagic, or open ocean environment. These species are highly mobile and physiologically adapted to traveling great distances with minimal effort. Much of what is known about the association between HMS and their migrations across vast open ocean habitat comes from tagging studies.

While the open ocean may appear featureless, there are major oceanographic features such as currents, temperature gradients, eddies, and fronts that occur on a large scale and may influence the distribution patterns of many oceanic species, including HMS. For instance, the Gulf Stream produces meanders, filaments, and warm and cold core rings that significantly affect the physical oceanography of the continental shelf and slope. These features tend to aggregate both predators and prey, and are frequently targeted by commercial fishing vessels. This western boundary current has its origins in the tropical Atlantic Ocean (i.e., the Caribbean Sea). The Gulf Stream system is made up of the Yucatan Current that enters the Gulf of Mexico through the Yucatan Straits; the Loop Current which is the Yucatan Current after it separates from Campeche Bank and penetrates the Gulf of Mexico in a clockwise flowing loop; the Florida Current, as it travels through the Straits of Florida and along the continental slope into the South Atlantic Bight; and the Antilles Current as it follows the continental slope (Bahamian Bank) northeast to Cape Hatteras. From Cape Hatteras it leaves the slope environment and flows into the deeper waters of the Atlantic Ocean.

The flow of the Gulf Stream as it leaves the Straits of Florida reaches maximum speeds of about 200 cm/s. During strong events, maximum current speeds greater than 250 cm/s have been recorded offshore of Cape Hatteras. The width of the Gulf Stream at the ocean surface ranges from 80 to 100 km (50 to 63 mi) and extends to depths of between 800 and 1,200 m (2,624 to 3,937 ft).

As a meander passes, the Gulf Stream boundary oscillates sequentially onshore (crest) and offshore (trough). A meander can cause the Gulf Stream to shift slightly shoreward or well offshore into deeper waters. The Gulf Stream behaves in two distinct meander modes (small and large), with the size of the meanders decreasing as they move northward along the coast. During the large meander mode the Gulf Stream front is seaward of the shelf break, with its meanders having large amplitudes. Additionally, frontal eddies and accompanying warm-water filaments are larger and closer to shore. During the small meander mode the Gulf Stream front is at the shelf break. Frontal eddies and warm-water filaments associated with small amplitude meanders are smaller and farther from shore. Since HMS tend to follow the edge of the Gulf Stream, their distance from shore can be greatly influenced by the patterns of meanders and eddies.

Meanders have definite circulation patterns and conditions superimposed on the statistical mean (average) condition. As a meander trough migrates in the direction of the Gulf Stream's flow, it upwells cool nutrient-rich water, which at times may move onto the shelf and may evolve into an eddy. These boundary features move south-southwest. As warm-water filaments, they transfer momentum, mass, heat, and nutrients to the waters of the shelf break.

Gulf Stream filaments are mesoscale events that occur regularly offshore the southeast United States. The filament is a tongue of water extending from the Gulf Stream pointing to the south. These form when meanders cause the extrusion of a warm surface filament of Gulf Stream water onto the outer shelf. The cul-de-sac formed by this extrusion contains a cold core that consists of a mix of outer-shelf water and nutrient-rich water. This water mix is a result of upwelling as the filament/meander passes along the slope. The period from genesis to decay typically is about two to three weeks.

The Charleston Gyre is a permanent oceanographic feature of the South Atlantic Bight, caused by the interaction of the Gulf Stream waters with the topographically irregular Charleston Bump. The gyre produces an upwelling of nutrients, which contributes significantly to primary and secondary productivity of the Bight. The degree of upwelling varies with the seasonal position and velocity of the Gulf Stream currents.

In the warm waters between the west edge of the Florida Current/Gulf Stream and 20° N and 40° N, pelagic brown algae, *Sargassum natans* and *S. fluitans*, form a dynamic structural habitat. The greatest concentrations are found within the North Atlantic Central Gyre in the Sargasso Sea. Large quantities of *Sargassum* frequently occur on the continental shelf off the southeastern United States. Depending on prevailing surface currents, this material may remain on the shelf for extended periods, be entrained into the Gulf Stream, or be cast ashore. During calm conditions *Sargassum* may form irregular mats or simply be scattered in small clumps. Oceanographic features such as internal waves and convergence zones along fronts aggregate the algae along with other flotsam into long linear or meandering rows collectively termed "windrows."

Pelagic *Sargassum* supports a diverse assemblage of marine organisms including fungi, micro- and macro-epiphytes, sea turtles, numerous marine birds, at least 145 species of invertebrates, and over 100 species of fishes. The fishes associated with pelagic *Sargassum* include juveniles as well as adults, including large pelagic adult fishes. Swordfish and billfish are among the fishes that can be found associated with *Sargassum*. The *Sargassum* community, consisting of the floating *Sargassum* (associated with other algae, sessile and free-moving invertebrates, and finfish) is important to some epipelagic predators such as wahoo and dolphin. The *Sargassum* community provides food and shelter from predation for juvenile and adult fish, including HMS, and may have other functions such as habitat for fish eggs and larvae.

Offshore water quality in the Atlantic is controlled by oceanic circulation, which, in the Mid-Atlantic is dominated by the Gulf Stream and by oceanic gyres. A shoreward, tidal and wind-driven circulation dominates as the primary means of pollutant transport between estuaries and the nearshore. Water quality in nearshore water masses adjacent to estuarine plumes and in water masses within estuaries is also influenced by density-driven circulation. Suspended sediment concentration can also be used as an indication of water quality. For the Atlantic coastal areas, suspended sediment concentration varies with respect to depth and distance from shore, the variability being greatest in the mid-Atlantic and South Atlantic. Re-suspended bottom sediment is the principal source of suspended sediments in offshore waters.

3.3.2.2 *Gulf of Mexico*

(Material in this section is largely a summary of information in MMS, 1996; Field *et al.*, 1991; and NOAA, 1997. Original sources of information are referenced in those documents.)

The Gulf of Mexico supports a great diversity of fish resources that are related to a variety of ecological factors, such as salinity, primary productivity, and bottom type. These factors differ widely across the Gulf of Mexico and between inshore and offshore waters. Characteristic fish resources are not randomly distributed; high densities of fish resources are associated with particular habitat types (e.g., east Mississippi Delta area, Florida Big Bend sea grass beds, Florida Middle Grounds, mid-outer shelf, and the DeSoto Canyon area). The highest values of surface primary production are found in the upwelling area north of the Yucatan Channel and in the DeSoto Canyon region. In terms of general biological productivity, the western Gulf is considered to be more productive in the oceanic region than is the eastern Gulf. Productivity of areas where HMS are known to occur varies between the eastern and western Gulf, depending on the influence of the Loop Current.

Coastal and Estuarine Habitats

There are 5.62 million hectares (ha) (13.88 million acres) of estuarine habitat among the five states bordering the Gulf. This includes 3.2 million ha (8 million acres) of open water, 2.43 million ha (6 million acres) of emergent tidal vegetation (including about 162,000 ha [400,318 acres] of mangroves), and 324,000 ha [800, 636 acres] of submerged vegetation. Estuaries are found from east Texas through Louisiana, Mississippi, Alabama, and northwest Florida and encompass more than 62,000 sq km (23,938 sq mi) of water surface area. Estuaries of the Gulf of Mexico export considerable quantities of organic material, thereby enriching the adjacent continental shelf areas, and many of these estuaries provide important habitat as pupping and nursery grounds for juvenile stages of many important invertebrate and fish species including many species of Atlantic sharks.

Coastal wetland habitat types that occur along the Gulf Coast include mangroves, non-forested wetlands (fresh, brackish, and saline marshes), and forested wetlands. Marshes and mangroves form an interface between marine and terrestrial habitats, while forested wetlands occur inland from marsh areas. Wetland habitats may occupy narrow bands or vast expanses, and can consist of sharply delineated zones of different species, monospecific stands of a single species, or mixed plant species communities.

Continental Shelf and Slope Areas

The Gulf of Mexico is a semi-enclosed, subtropical sea with a surface area of approximately 1.6 million sq km (0.6 million sq mi). The main physiographic regions of the Gulf basin are the continental shelf, continental slope and associated canyons, the Yucatan and Florida Straits, and the abyssal plains. The U.S. continental shelf is narrowest, only 16 km (9.9 mi) wide, off the Mississippi River. The continental shelf width varies significantly from about 350 km (217 mi) offshore western Florida, 156 km (97 mi) off Galveston, TX, and decreasing to 88 km (55 mi) off Port Isabel near the Mexican border. The depth of the central abyss ranges to 4,000 m (13,000 ft). The Gulf is unique because it has two entrances: the Yucatan Strait and the Straits of Florida. The Gulf's general circulation is dominated by the Loop Current and its associated eddies. The Loop current is caused by differences between the sill depths of the two straits. Coastal and shelf circulation, on the other hand, is driven by several forcing mechanisms: wind stress, freshwater input, buoyancy and mass fluxes, and transfer of momentum and energy through the seaward boundary.

In the Gulf, the continental shelf extends seaward from the shoreline to about the 200-m water depth (660 ft), and is characterized by a gentle slope of less than one degree. The continental slope extends from the shelf edge to the continental rise, usually at about the 2,000-m (6,500 ft) water depth. The topography of the slope in the Gulf is uneven and is broken by canyons, troughs, and escarpments. The gradient on the slope is characteristically one to six degrees, but may exceed 20 degrees in some places, particularly along escarpments. The continental rise is the apron of sediment accumulated at the base of the slope. The incline is gentle with slopes of less than one degree. The abyssal plain is the basin floor at the base of the continental rise.

Physical Oceanography

The Gulf receives large amounts of freshwater runoff from the Mississippi River as well as from a host of other drainage systems. In recent years, large amount of nutrient laden runoff from the Mississippi River have resulted in large hypoxic or low oxygen areas in the Gulf. This "dead zone" may affect up to 16,500 sq km (6,371 sq mi) during the summer, resulting in unfavorable habitat conditions for a wide variety of species.

Sea-surface temperatures in the Gulf range from nearly constant throughout (isothermal) (29° to 30°C [84° to 86°F]) in August to a sharp horizontal gradient in January, (25°C [77°F]) in the Loop Current core to 14° to 15° C (57° to 59°F) along the northern shelf). The vertical distribution of temperature reveals that in January, the thermocline depth is about 30 to 61 m (98 to 200 ft) in the northeast Gulf and 91 to 107 m (298 to 350 ft) in the northwest Gulf. In May, the thermocline depth is about 46 m (150 ft) throughout the entire Gulf.

Sea surface salinities along the north Gulf vary seasonally. During months of low freshwater input, salinities near the coastline range between 29 to 32 ppt. High freshwater input conditions during the spring and summer months result in strong horizontal gradients and inner shelf salinities less than 20 ppt. The mixed layer in the open Gulf, from the surface to a depth of approximately 100 to 150 m (330 to 495 ft), is characterized by salinities between 36.0 and 36.5 ppt.

Sharp discontinuities of temperature and/or salinity at the sea surface, such as the Loop Current front or fronts associated with eddies or river plumes, are dynamic features that may act to concentrate buoyant material such as detritus, plankton, or eggs and larvae. These materials are transported, not by the front's movements or motion across the front, but mainly by lateral movement along the front. In addition to open oceanfronts, a coastal front, which separates turbid, lower salinity water from the open-shelf regime, is probably a permanent feature of the north Gulf shelf. This front lies about 30 to 50 km (19 to 31 mi) offshore. In the Gulf, these fronts are the most commonly utilized habitat of the pelagic HMS species.

The Loop Current is a highly variable current entering the Gulf through the Yucatan Straits and exiting through the Straits of Florida (as a component of the Gulf Stream) after tracing an arc that may intrude as far north as the Mississippi-Alabama shelf. This current has been detected down to about 1,000 m (3,300 ft) below the surface. Below that level there is evidence of a countercurrent. When the Loop Current extends into or near shelf areas, instabilities, such as eddies, may develop that can push warm water onto the shelf or entrain cold water from the shelf. These eddies consist of warm water rotating in a clockwise fashion. Major Loop Current eddies have diameters on the order of 300 to 400 km (186 to 249 miles), and may extend to a depth of about 1,000 m. Once these eddies are free from the Loop Current, they travel into the western Gulf along various paths to a region between 25° N to 28° N and 93° W to 96° W. As eddies travel westward a decrease in size occurs due to mixing with resident waters and friction with the slope and shelf bottoms. The life of an individual eddy, until its eventual assimilation by regional circulation in the western Gulf, is about one year. Along the Louisiana/Texas slope, eddies are frequently observed to affect local current patterns, hydrographic properties, and possibly the biota of fixed oil and gas platforms or hard bottoms. Once an eddy is shed, the Loop Current undergoes major dimensional adjustments and reorganization.

3.3.2.3 *U.S. Caribbean*

(Material in this section is largely a summary of information in Appeldoorn and Meyers, 1993. Original sources of information are referenced in that document.)

The waters of the Caribbean region include the coastal waters surrounding the U.S. Virgin Islands and Puerto Rico. All of these Caribbean islands, with the exception of St. Croix, are part of a volcanic chain of islands formed by the subduction of one tectonic plate beneath another. Tremendously diverse habitats (rocky shores, sandy beaches, mangroves, seagrasses, algal plains, and coral reefs) and the consistent light and temperature regimes characteristic of the tropics are conducive to high species diversity.

The waters of the Florida Keys and southeast Florida are intrinsically linked with the waters of the Gulf of Mexico and the waters of the Caribbean to the west, south, and east, and to the waters of the South Atlantic Bight to the north. These waters represent a transition from insular to continental regimes and from tropical to temperate regimes. This zone, therefore, contains one of the richest floral and faunal complexes.

Coastal and Estuarine Habitats

Although the U.S. waters of the Caribbean are relatively nutrient poor, and therefore have low rates of primary and secondary productivity, they display some of the greatest diversity of any part of the South Atlantic region. High and diverse concentrations of biota are found where habitat is abundant. Coral reefs, sea grass beds, and mangrove ecosystems are the most productive of the habitat types found in the Caribbean, but other areas such as soft-bottom lagoons, algal hard grounds, mud flats, salt ponds, sandy beaches, and rocky shores are also important in overall productivity. These diverse habitats allow for a variety of floral and faunal populations.

Offshore, between the sea grass beds and the coral reefs and in deeper waters, sandy bottoms and algal plains dominate. These areas may be sparsely or densely vegetated with a canopy of up to one meter of red and brown algae. Algal plains are not areas of active sand transport. These are algae-dominated sandy bottoms, often covered with carbonate nodules. They occur primarily in deep water (> 15 m, or 50 ft), and account for roughly 70 percent of the area of the insular shelf of the U.S. Virgin Islands. Algal plains support a variety of organisms including algae, sponges, gorgonians, solitary corals, mollusks, fish, and worms, and may serve as critical juvenile habitat for commercially important (and diminishing) species such as queen triggerfish and spiny lobsters.

Coral reefs and other coral communities are some of the most important ecological (and economic) coastal resources in the Caribbean. They act as barriers to storm waves and provide habitat for a wide variety of marine organisms, including most of the economically important species of fish and shellfish. They are the primary source for carbonate sand, and serve as the basis for much of the tourism. Coral communities are made by the build up of calcium carbonate produced by living animals, coral polyps, in symbiosis with a dinoflagellate, known as zooxanthellae. During summer and early fall, most of the coral building organisms are at or near the upper temperature limit for survival and so are living under natural conditions of stress. Further increase in local or global temperature could prove devastating.

Sea grass beds are highly productive ecosystems that are quite extensive in the Caribbean; some of the largest sea grass beds in the world lie beyond the shore on both sides of the Keys. Sea grass beds often occur in close association with shallow-water coral reefs. Seagrasses are flowering plants that spread through the growth of roots and rhizomes. These act to trap and stabilize sediments, reduce shoreline erosion, and buffer coral reefs; they provide food for fish, sea turtles (heavy grazers), conch, and urchins; they provide shelter and habitat for many adult species and numerous juvenile species who rely on the sea grass beds as nursery areas; and they provide attachment surfaces for calcareous algae.

Mangrove habitats are very productive coastal systems that support a wide variety of organisms. The mangrove food web is based largely on the release of nutrients from the decomposition of mangrove leaves, and in part on the trapping of terrestrial material. Red mangroves (*Rhizophora mangle*), with their distinctive aerial prop roots, grow along the shoreline, often in mono-specific stands. The roots of the red mangroves help to trap sediments and pollutants associated with terrestrial runoff and help to buffer the shore from storm waves. Red mangrove forests support a diverse community of sponges, tunicates, algae, larvae, and corals, as well as juvenile and adult fish and shellfish. Black mangroves (*Aveicennia germinans*) and white mangroves (*Laguncularia racemosa*) grow landward of the red mangroves. They also act as important sediment traps. Exposed and sheltered mangrove shorelines are common throughout the U.S. Caribbean.

Throughout the U.S. Caribbean, both rocky shores and sandy beaches are common. While many of these beaches are high-energy and extremely dynamic, buffering by reefs and seagrasses allows some salt-tolerant plants to colonize the beach periphery. Birds, sea turtles, crabs, clams, worms, and urchins use the intertidal areas.

Salt ponds, common in the U.S. Virgin Islands, are formed when mangroves or fringing coral reefs grow or storm debris is deposited, effectively isolating a portion of a bay. The resulting “pond” undergoes significant fluctuations of salinity with changes in relative evaporation and runoff. The biota associated with salt ponds are, therefore, very specialized, and usually somewhat limited. Salt ponds are extremely important in trapping terrestrial sediments before they reach the coastal waters.

Insular Shelf and Slope Areas

Puerto Rico and the U.S. Virgin Islands contain a wide variety of coastal marine habitats, including coral and rock reefs, sea grass beds, mangrove lagoons, sand and algal plains, soft bottom areas, and sandy beaches. These habitats are, however, very patchily distributed. Nearshore waters range from zero to 20 m (66 ft) in depth, and outer shelf waters range from 20 to 30 m (66 to 99 ft) in depth, the depth of the shelf break. Along the north coast the insular shelf is very narrow (two to three km wide), seas are generally rough, and few good harbors are present. The coast is a mixture of coral and rock reefs, and sandy beaches. The east coast has an extensive shelf that extends to the British Virgin Islands. Depth ranges from 18 to 30 m (59 to 99 ft). Much of the bottom is sandy, commonly with algal and sponge communities. The southeast coast has a narrow shelf (eight km wide). About 25 km (15.5 mi) to the southeast is Grappler Bank, a small seamount with its summit at a depth of 70 m (231 ft). The central south coast broadens slightly to 15 km (99 mi) and an extensive sea grass bed extends nine kilometers offshore to Caja de Muertos Island. Further westward, the shelf narrows again to just 2 km (1.2 mi) before widening at the southwest corner to over 10 km (6 mi). The entirety of the southern shelf is characterized by hard or sand-algal bottoms with emergent coral reefs, grass beds, and shelf edge. Along the southern portion of the west coast the expanse of shelf continues to widen, reaching 25 km (15.5 mi) at its maximum. A broad expanse of the shelf is found between 14 and 27 m (46 and 99 ft), where habitats are similar to those of the south coast. To the north, along the west coast, the shelf rapidly narrows to two to three kilometers.

Physical Oceanography

U.S. Caribbean waters are primarily influenced by the westward flowing North Equatorial Current, the predominant hydrological driving force in the Caribbean region. It flows from east to west along the northern boundary of the Caribbean plateau and splits at the Lesser Antilles, flowing westward along the north coasts of the islands.

The north branch of the Caribbean Current flows west into the Caribbean Basin at roughly 0.5 m (1.7 ft) per second. It is located about 100 km (62 mi) south of the islands, but its position varies seasonally. During the winter it is found further to the south than in summer. Flow along the south coast of Puerto Rico is generally westerly, but this is offset by gyres formed between the Caribbean Current and the island. The Antilles Current flows to the west along the northern edge of the Bahamas Bank and links the waters of the Caribbean to those of southeast Florida.

Coastal surface water temperatures remain fairly constant throughout the year and average between 26° and 30°C (79° and 86°F). Salinity of coastal waters is purely oceanic and therefore is usually around 36 ppt. However, in the enclosed or semi-enclosed embayments salinity may vary widely depending on fluvial and evaporational influences.

It is believed that no up welling occurs in the waters of the U.S. Caribbean (except perhaps during storm events) and, since the waters are relatively stratified, they are severely nutrient-limited. In tropical waters nitrogen is the principal limiting nutrient.

3.3.3 Fishing Activities That May Adversely Affect EFH

The EFH regulations and the Magnuson-Stevens Act require the fishery management councils (Councils) and NMFS, on behalf of the Secretary of Commerce, to minimize adverse effects on EFH from fishing activities to the extent practicable. Adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem. Based on an assessment of the potential adverse effects of all fishing equipment types used within an area identified as EFH, the Council should act if there is evidence that a fishing practice is having an identifiable adverse effect on the EFH.

An assessment was made of the gears and practices in order to determine whether HMS fishing activities cause adverse impacts on EFH in the 1999 HMS FMP. Impacts of

HMS and non-HMS fishing gears and practices were analyzed by examining published literature and anecdotal evidence of potential impacts or comparable impacts from other fisheries. Based on this assessment, NMFS considers that the fishing gears and methods of the HMS fisheries do not appear to have adverse impacts on EFH. Even if there were any adverse impacts, such impacts are not expected to be "more than minimal and not temporary in nature" (50 CFR 600.815(a)(2)(ii)). There is the possibility that other (non-HMS) fisheries may adversely impact HMS EFH, and some HMS gear may impact other EFH; however, the degree of that impact is difficult to ascertain from the data currently available. NMFS is aware that other actions may be required in the future as a greater understanding of the impacts of fishing gear on fish habitat is gained. Future management measures could include fishing gear or practice restrictions, additional time/area closures, or harvest limits on the take of species that provide structural habitat or of prey species. Any areas that may be closed to fishing should be used as experimental control areas to research the effects of fishing gears on habitat.

3.3.4 Non-Fishing Activities That May Adversely Affect EFH and Respective Fishing Measures

Section 600.815 (a)(4) of the EFH regulations requires that FMP's identify non-fishing related activities that may adversely affect EFH of managed species, either quantitatively or qualitatively, or both. In addition, Section 600.815 (a)(6) requires that FMP's recommend conservation measures describing options to avoid, minimize, or compensate for the adverse effects identified.

Broad categories of activities that may adversely affect HMS EFH include, but are not limited to: (1) actions that physically alter structural components or substrate, e.g., dredging, filling, excavations, water diversions, impoundments and other hydrologic modifications; and (2) actions that result in changes in habitat quality, e.g., point source discharges, activities that contribute to non-point-source pollution and increased sedimentation, introduction of potentially hazardous materials, or activities that diminish or disrupt the functions of EFH. If these actions are persistent or intense enough they can result in major changes in habitat quantity as well as quality, conversion of habitats, or in complete abandonment of habitats by some species.

3.4 PROTECTED RESOURCES

The unintended capture of species listed under the ESA, MMPA, and the Migratory Bird Treaty Act (collectively known as "protected" species) is known to occur as a result of HMS longline fishery activities**.** A description of the impacted species as well as known data accounting for the frequency of such bycatch interactions is outlined below and updates the 1999 HMS FMP.

3.4.1 Sea Turtles

The following summary of the information available regarding sea turtle populations and interactions with HMS longline fisheries represents an update to the HMS FMP. Other

NOAA Fisheries documents containing detailed information on sea turtle population trends and/or longline interactions include the June 1, 2004, BiOp for the fishery, the December 2002, BiOp for the S.E. shrimp trawl fishery, and the June 14, 2001, HMS BiOp. The June 1, 2004, BiOp is discussed further in Section 4.3.

The HMS longline fisheries have the potential to interact with any of the five species of sea turtles in the Atlantic (including the Gulf of Mexico), but the vast majority of the interactions occur with loggerhead and leatherback sea turtles. The status of the five sea turtles can be found in Table 3.11.

Loggerhead sea turtles

The loggerhead sea turtle was listed as a threatened species in 1978. This species inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Within the continental U.S. loggerheads nest from Louisiana to Virginia. The major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida. Developmental habitat for small juveniles includes the pelagic waters of the North Atlantic and the Mediterranean Sea.

The loggerhead sea turtles in the action area (west Atlantic Ocean, Caribbean Sea, and Gulf of Mexico) represent differing proportions of five western north Atlantic subpopulations, as well as unidentified subpopulations from the eastern Atlantic. The five nesting assemblages are the Northern subpopulation, occurring from North Carolina to northeast Florida; the South Florida subpopulation, occurring from 29° N. latitude on the east coast to Sarasota on the west coast; the Florida Panhandle subpopulation; the Yucatán subpopulation from the eastern Yucatán Peninsula, Mexico; and the Dry Tortugas subpopulation from the Dry Tortugas (located west of the Florida Keys), Florida. The June 14, 2001, BiOp considered these subpopulations for the analysis, with particular emphasis on the northern subpopulation of loggerhead sea turtles because unlike the population as a whole, this nesting subpopulation is thought to be declining, or at best, stable. Loggerheads reported captured in the pelagic longline fishery in the open ocean are mostly pelagic juveniles. It is assumed that overall interaction of loggerhead sea turtles with the pelagic longline fishery is in proportion with the overall stock sizes of each nesting aggregation (NOAA Fisheries, 2004c).

In examining the nesting trend for the northern subpopulation, the turtle expert working group (TEWG) concluded that it is stable or declining (1998, 2000). The analysis described in the NOAA Fisheries 2001 stock assessment report summarized the trend analyses for the number of nests sampled from beaches for the northern subpopulation and the south Florida subpopulation and concluded that from 1978-1990, the northern subpopulation has been stable at best and possibly declining (less than 5 percent per year). From 1990 to the present, the number of nests in the northern subpopulation has been increasing at 2.8 - 2.9 percent annually; however, there are confidence intervals about these estimates that include no growth (0 percent). Over the same time frame, the south Florida population has been increasing at 5.3 - 5.4 percent per year from 1978-

1990, and increasing at 3.9 - 4.2 percent since 1990. This figure was derived from the most optimistic, and perhaps the least reliable, analysis. NOAA Fisheries (2001) cautioned that “it is an unweighted analysis and does not consider the beaches’ relative contribution to the total nesting activity of the subpopulation and must be interpreted with some caution.” In fact, more recent analysis, including nesting data through 2003, indicate that there is no discernable trend over the past 15 years in the south Florida subpopulation (NOAA Fisheries, 2004c). All other data and analysis indicated that the number of loggerhead sea turtle nests in the northern subpopulation were remaining the same or declining.

Loggerhead sea turtles are primarily exposed to pelagic longline gear in the pelagic juvenile stage. According to observer records, an estimated 10,034 loggerhead sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992 - 2002, of which 81 were estimated to be brought to the vessel already dead (Table 3.10). This figure does not account for post-release mortalities. However, the U.S. fleet accounts for a small proportion (5 - 8 percent) of the total hooks fished in the Atlantic Ocean compared to other nations, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (Carocci and Majkowski, 1998). Reports of incidental takes of turtles are incomplete for many of these nations (see NOAA Fisheries, 2001b for a description of take records). An analysis of the international pelagic longline fisheries’ impacts on loggerhead sea turtles throughout the Atlantic and Mediterranean estimated that the annual take ranged from 210,000 - 280,000 incidences (Lewison *et al.*, 2004).

Leatherback sea turtles

The leatherback sea turtle was listed as endangered on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans; the Caribbean Sea; and the Gulf of Mexico (Ernst and Barbour, 1972). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations between 90°N and 20°S, to and from the tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NOAA Fisheries, 2001b). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NOAA Fisheries, 2001b).

The conflicting information regarding the status of Atlantic leatherback sea turtles makes it difficult to conclude whether or not the population is currently in decline. Numbers at some nesting sites are up, while numbers at others are down. Data collected in southeast Florida clearly indicate increasing numbers of nests for the past twenty years (9.1 - 11.5 percent increase), although it is critical to note that there was also an increase in the survey area in Florida over time (NOAA Fisheries, 2001b). The largest leatherback rookery in the western north Atlantic remains along the northern coast of South America in French Guiana and Suriname. While Spotila *et al.* (1996) indicated that turtles may have been shifting their nesting from French Guiana to Suriname due to beach erosion, analyses show that the overall area trend in number of nests has been negative since 1987, declining at a rate of 15.0 - 17.3 percent per year (NOAA Fisheries, 2001b). If turtles are not nesting elsewhere, it appears that the Western Atlantic portion of the population is being subjected to high anthropogenic mortality rates, resulting in a continued decline in numbers of nesting females.

Leatherback sea turtles are exposed to pelagic fisheries throughout their life cycle. According to observer records, an estimated 9,302 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992 - 2002, of which 121 were brought to the vessel already dead (Table 3.10). This figure does not account for post-release mortalities. Leatherback sea turtles make up a significant portion of takes in the Gulf of Mexico and south Atlantic areas, but are more often released alive. The U.S. fleet accounts for five to eight percent of the hooks fished in the Atlantic Ocean. Other nations, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland also fish in these waters (Carocci and Majkowski, 1998). Reports of incidental takes of turtles are incomplete for many of these nations (see NOAA Fisheries, 2001b, for a description of take records). Throughout the Atlantic basin, including the Mediterranean Sea, a total of 30,250 - 70,000 leatherback sea turtles are estimated to be captured by pelagic longline fisheries each year (Lewison *et al.*, 2004).

3.4.2 Marine Mammals

NOAA Fisheries published the final 2003 Marine Mammal Protection Act (MMPA) List of Fisheries on July 15, 2003 (68 FR 41725). The Atlantic Ocean, Caribbean, and Gulf of Mexico pelagic longline fishery is classified as Category I (frequent serious injuries and mortalities incidental to commercial fishing) and the southeastern Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities). The following fisheries are classified as Category III (remote likelihood or no known serious injuries or mortalities): Atlantic tuna purse seine; Gulf of Maine and mid Atlantic tuna, swordfish, and shark hook-and-line/harpoon; southeastern mid Atlantic and Gulf of Mexico shark bottom longline; and mid Atlantic, southeastern Atlantic, and Gulf of Mexico pelagic hook-and-line/harpoon fisheries. Data are collected for the fisheries indicating whether the animal was removed dead or alive. In addition to mammals released dead from fishing gear, which is uncommon in the pelagic longline fishery, NOAA Fisheries must consider post-release mortality of mammals released alive when determining fishery impacts. Further details on the number of takes in the pelagic longline fisheries in the Atlantic were presented previously in Section 3.2.

3.4.3 Seabirds

Seabirds are protected under the Migratory Bird Treaty Act; endangered seabirds are further protected under the Endangered Species Act; and all migratory birds are protected under E.O. 13186. The United States has developed a National Plan of Action in response to the Food and Agriculture Organization International Plan of Action to Reduce Incidental Seabird Takes in Longline Fisheries. Many seabird populations are especially slow to recover from mortality because their reproductive potential is low (one egg per year and late sexual maturation). They forage on the surface, but some can also pursue prey fish swimming at shallow depths, which makes seabirds somewhat susceptible to driftnets, shallow set longlines, and longline gear being deployed. They are possibly at the highest risk during the process of setting and hauling the gear.

Observer data for the Atlantic pelagic longline fishery from 1992 through 2003 indicate that bycatch is relatively low (Table 3.13). Since 1992, a total of 116 seabird interactions have been observed, with 80 seabirds observed killed in the Atlantic pelagic longline fishery. Approximately 80 to 100 active U.S. pelagic longline vessels currently operate in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. No expanded estimates of seabird bycatch or catch rates are available for the pelagic longline fishery. Observed bycatch has ranged from one to 18 seabirds observed dead per year and zero to 15 seabirds observed released alive per year from 1992 through 2003. Half of the seabirds observed were not identified to species (n = 58). Of those seabirds identified, gulls represent the largest group (n = 29), followed by greater shearwaters (n = 19), and northern gannets (n = 8) (Table 3.14). Greater shearwaters experienced the highest mortality (100 percent), followed by gulls (76 percent), and unidentified seabirds (67 percent). Northern gannets had the lowest mortality rate (12 percent).

Preliminary estimates of expanded seabird bycatch and bycatch rates from 1995-2002, varied by year and species with no apparent pattern (Table 3.15). The estimated number of all seabirds caught and discarded dead ranged from zero to 468 per year, while live discards ranged from zero to 292 per year. The annual bycatch rate of birds discarded dead ranged from zero to 0.0486 birds per 1,000 hooks while live discards ranged from zero to 0.0303 birds per 1,000 hooks.

Table 3.1. Stock Assessment Summary Table managed under ATCA. Source: NOAA Fisheries, 2004b, 2005; SCRS, 2004.

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
North Atlantic Swordfish	B_{02}/B_{MSY} = 0.94 (0.75-1.24)	*$0.8B_{MSY}$*	F_{01}/F_{MSY} = 0.75 (0.54-1.06)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is not occurring, stock is in recovery
South Atlantic Swordfish	*Not estimated*	*$0.8B_{MSY}$*	*Not estimated*	F_{year}/F_{MSY} = 1.00	Fully fished; Overfishing may be occurring.*
Atlantic Blue Marlin	B_{00}/B_{MSY} = 0.4 (0.25 - 0.6)	*$0.9B_{MSY}$*	F_{99}/F_{MSY} = 4.0 (2.5 - 6.0)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
Atlantic White Marlin	B_{00}/B_{MSY} = 0.12 (0.06 - 0.25)	*$0.85B_{MSY}$*	F_{00}/F_{MSY} = 8.28 (4.5 – 15.8)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
West Atlantic Sailfish	*Not estimated*	*$0.75B_{MSY}$*	*Not estimated*	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
West Atlantic Bluefin Tuna	SSB_{01}/SSB_{MSY}= 0.31 (low recruitment); 0.06 (high recruitment) SSB_{01}/SSB_{75} = 0.13 (low recruitment); 0.13 (high recruitment)	*$0.86SSB_{MSY}$*	F_{01}/F_{MSY} = 2.35 (low recruitment scenario) F_{01}/F_{MSY} = 4.64 (high recruitment scenario)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
East Atlantic Bluefin Tuna	SSB_{00}/SSB_{70} = 0.80	*Not estimated*	F_{00}/F_{max} = 2.4	*Not estimated*	Overfished; overfishing is occurring. *
Atlantic Bigeye Tuna	B_{03}/B_{MSY} = 0.85-1.07	*$0.6B_{MSY}$ (age 2+)*	F_{02}/F_{MSY} = 0.73-1.01	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
Atlantic Yellowfin Tuna	B_{01}/B_{MSY} = 0.73 - 1.10	*$0.5B_{MSY}$ (age 2+)*	F_{01}/F_{MSY} = 0.87-1.46	F_{year}/F_{MSY} = 1.00	Approaching an overfished condition.
North Atlantic Albacore Tuna	B_{00}/B_{MSY} = 0.68 (0.52-0.86)	*$0.7B_{MSY}$*	F_{00}/F_{MSY} = 1.10 (0.99 - 1.30)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
South Atlantic Albacore Tuna	B_{02}/B_{MSY} = 1.66 (0.74-1.81)	*Not estimated*	F_{02}/F_{MSY} = 0.62 (0.46-1.48)	*Not estimated*	Not overfished; overfishing not occurring.*
West Atlantic Skipjack Tuna	*Unknown*	*Unknown*	*Unknown*	F_{year}/F_{MSY} = 1.00	Unknown

*** South Atlantic swordfish, South Atlantic albacore and East Atlantic bluefin tuna are not found in the U.S. EEZ and, therefore, are not managed under the Magnuson-Stevens Act.**
**** Based on "Sustaining and Rebuilding", National Marine Fisheries Service, 2003, - Report to Congress - The Status of U.S. Fisheries, May 2004.**

Table 3.2. Summary Table of Biomass and Fishing Mortality for Small Coastal Sharks (SCS) Source: Cortes, 2002.

Species/ Complex	MSY (B_{MSY}) million lb dw	2001 Relative Biomass Level (B_{2001}/ B_{MSY})	Minimum Stock Size Threshold MSST = (0.5)B_{MSY} if M>=0.5 MSST = (1-M)Bmsy if M<0.5	Fishing Mortality Rate (F_{2000})	Maximum Fishing Mortality Threshold (F_{MSY})	Outlook
Small Coastal Sharks (SCS)	7.0-2.2	1.38-2.39	16.2-50.2	0.03-0.24	0.04-0.78	Not overfished; No overfishing occuring
Finetooth Sharks	0.26-0.05	1.39-2.37	0.4-1.4	0.13-1.50	0.03-0.44	Not overfished; Overfishing is occuring
Bonnethead Sharks	1.8-0.5	1.46-2.78	2.3-7.3	0.03-0.18	0.05-0.53	Not overfished; No overfishing occuring
Atlantic Sharpnose Sharks	7.8-1.9	1.69-3.16	11.5-33.4	0.02-0.06	0.04-0.42	Not overfished; No overfishing occuring
Blacknose Sharks	0.8-0.2	1.92-3.15	1.6-4.5	0.02-0.19	0.03-0.44	Not overfished; No overfishing occuring

Table 3.3. Summary Table of Biomass and Fishing Mortality for Large Coastal Sharks (LCS). Source: Cortes *et al.*, 2002

Species/ *Complex*	**2001 Biomass (N_{2001})**	**2001 Relative Biomass (N_{2001}/N_{MSY})**	**Fishing Mortality Rate (F_{2001})**	**Maximum Fishing Mortality Threshold (F_{MSY})**	**Outlook**
Large Coastal Complex	2,940-10,156	0.46-1.18	0.07-0.21	0.05-0.10	Overfished; Overfishing is occurring
Sandbar Sharks	1,027-4.86 E8	$3.25E^{-4}$-2.22	0.0001-0.70	0.05-0.46	Not overfished; Overfishing is occurring
Blacktip Sharks	5,587-3.16 E7	0.79-1.66	0.01-0.21	0.06-0.18	Not overfished; No overfishing occurring

Table 3.4. Common names of shark species included within the four species management units under the purview of the HMS management division.

Management Unit	**Shark Species Included**
Large Coastal Sharks (11)	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, and great hammerhead sharks
Small Coastal Sharks (4)	Atlantic sharpnose, blacknose, finetooth, and bonnethead sharks
Pelagic Sharks (5)	Shortfin mako, thresher, oceanic whitetip, porbeagle, and blue sharks
Prohibited Species (19)	Whale, basking, sandtiger, bigeye sandtiger, white, dusky, night, bignose, Galapagos, Caribbean reef, narrowtooth, longfin mako, bigeye thresher, sevengill, sixgill, bigeye sixgill, Caribbean sharpnose, smalltail, and Atlantic angel sharks.

Table 3.5 Average Number of Hooks per Pelagic Longline Set, 1999 - 2003. Source: Data reported in pelagic longline logbook.

Target Species	**1999**	**2000**	**2001**	**2002**	**2003**
Swordfish	521	550	625	695	712
Bigeye Tuna	768	454	671	755	967
Yellowfin Tuna	741	772	731	715	723
Mix of tuna species	NA	638	719	767	764
Shark	613	621	571	640	970
Dolphin	NA	943	447	542	692
Other species	781	504	318	300	865
Mix of species	738	694	754	756	750

Table 3.6. Reported Landings in the U.S. Atlantic Pelagic Fishery (in mt ww) for 1999 - 2003. Source: U.S. National Report to ICCAT, 2004 (NOAA Fisheries, 2004a).

Species	1999	2000	2001	2002	2003
Yellowfin Tuna	3,374	2,901	2,201	2,573	2,154
Skipjack Tuna	2.0	1.8	4.3	2.5	4.2
Bigeye Tuna	929.1	531.9	682.4	535.8	284.9
Bluefin Tuna	73.5	66.1	37.5	49.9	81.4
Albacore Tuna	194.5	147.3	193.8	155	110.9
Swordfish N.*	3,362.4	3,315.8	2,483	2,598.8	2,772.1
Swordfish S.*	185.2	143.8	43.2	199.9	20.9

* Includes landings and estimated discards from scientific observer and logbook sampling programs.

Table 3.7. Reported Catch of Species Caught by U.S. Atlantic Pelagic Longlines, in Number of Fish for 1999 - 2003. Source: Pelagic Longline Logbook Data.

Species	1999	2000	2001	2002	2003
Swordfish Kept	67,120	62,978	47,560	49,320	51,835
Swordfish Discarded	20,558	17,074	13,993	13,035	11,829
Blue Marlin Discarded	1,253	1,443	635	1,175	595
White Marlin Discarded	1,969	1,261	848	1,438	809
Sailfish Discarded	1,407	1,091	356	379	277
Spearfish Discarded	151	78	137	148	108
Bluefin Tuna Kept	263	235	177	178	273
Bluefin Tuna Discarded	604	737	348	585	881
Bigeye, Albacore, Yellowfin, Skipjack Tunas Kept	114,438	94,136	80,466	79,917	63,321
Pelagic Sharks Kept	2,894	3,065	3,460	2,987	3,037
Pelagic Sharks Discarded	28,967	28,046	23,813	22,828	21,705
Large Coastal Sharks Kept	6,382	7,896	6,478	4,077	5,326
Large Coastal Sharks Discarded	5,442	6,973	4,836	3,815	4,813
Dolphin Kept	31,536	29,125	27,586	30,384	29,372
Wahoo Kept	5,136	4,193	3,068	4,188	3,919
Turtles Discarded	631	271	424	465	399
Number of Hooks (X 1,000)	*7,902*	*7,976*	*7,564*	*7,150*	*7,008*

Table 3.8. Estimated International Longline Landings of HMS, Other than Sharks, for All Countries in the Atlantic: 1999 - 2003 (mt ww)[1]. Source: SCRS, 2004.

	1999	2000	2001	2002	2003
Swordfish (N. Atl + S. Atl)	25,201	24,990	22,562	22,127	20,788
Yellowfin Tuna (W. Atl)[2]	11,596	11,465	12,684	11,578	10,178
Bigeye Tuna	76,513	70,976	55,162	46,509	51,606
Bluefin Tuna (W. Atl.)[2]	914	859	610	727	188
Albacore Tuna (N. Atl + S. Atl)	27,209	28,881	29,667	27,779	27,879
Skipjack Tuna (N. Atl + S. Atl)	51	60	70	109	106
Blue Marlin (N. Atl. + S. Atl.)[3]	2,359	2,187	1,638	1,337	1,671
White Marlin (N. Atl. + S. Atl.)[3]	981	893	593	730	557
Sailfish (W. Atl.)[3]	524	811	812	1,271	853
Total	145,348	141,122	123,798	112,167	113,826
U.S. Longline Landings (2003 and 2004 U.S. Natl. Report)[4]	8,331.1	7,253.5	5,695.3	6,203.9	5,468.4
U.S. Longline Landings as a Percent of Total Longline Landings	5.7	5.1	4.6	5.5	4.8

[1]Landings include those classified by the SCRS as longline landings for all areas
[2]Note that the United States has not reported participation in the E. Atl yellowfin tuna fishery since 1983 and has not participated in the E. Atl bluefin tuna fishery since 1982.
[3]Includes U.S. *dead discards.*
[4]Includes swordfish, blue marlin, white marlin, and sailfish longline discards.

Table 3.9. ICCAT Bycatch Table (LL, longline; GILL, gillnets; PS, purse-seine; BB, baitboat; HARP, harpoon; Trap, traps). Source: SCRS 2004.

ICCAT Bycatch Table (www.iccat.es)

Count	Group	LL	GILL	PS	BB	HARP	TRAP	OTHER
214	*All Groups*	149	110	78	12	33	20	43
		69.6%	51.4%	36.4%	5.6%	15.4%	9.3%	20.1%
12	*Skates and Rays*	10	6	6	0	2	0	1
		83.3%	50.0%	50.0%	0.0%	16.7%	0.0%	8.3%
46	*Coastal Sharks*	45	19	6	1	7	2	9
		97.8%	41.3%	13.0%	2.2%	15.2%	4.3%	19.6%
11	*Pelagic Sharks*	10	7	5	0	5	2	4
		90.9%	63.6%	45.5%	0.0%	45.5%	18.2%	36.4%
23	*Teleosts (ICCAT Species)*	23	18	16	9	6	7	11
		100.0%	78.3%	69.6%	39.1%	26.1%	30.4%	47.8%
82	*Teleosts (excluding Scombridae and billfishes)*	44	37	25	2	5	4	17
		53.7%	45.1%	30.5%	2.4%	6.1%	4.9%	20.7%
5	*Sea Turtles*	3	4	5	0	2	1	1
		60.0%	80.0%	100.0%	0.0%	40.0%	20.0%	20.0%
9	*Sea Birds*	8	2	0	0	0	0	0
		88.9%	22.2%	0.0%	0.0%	0.0%	0.0%	0.0%
26	*Marine Mammals*	6	17	15	0	6	4	0
		23.1%	65.4%	57.7%	0.0%	23.1%	15.4%	0.0%

Table 3.10. Observer Coverage of the Pelagic Longline Fishery. Source: Yeung, 2001; Garrison, 2003; and Garrison and Richards, 2004.

Year	**Number of Sets Observed**			**Percentage of Total Number of Sets**		
1999	420			3.8		
2000	464			4.2		
	Total	**Non-NED**	**NED**	**Total**	**Non-NED**	**NED**
2001*	403	217	186	3.7	2.0	100.0
2002*	856	353	503	8.9	3.7	100.0
2003*	1088	552	536	11.5	6.2	100.0

*In 2001, 2002, and 2003, 100 percent observer coverage was required in the NED research experiment.

Table 3.11 Status of Atlantic Sea Turtle Populations. **Source: NOAA Fisheries, 2001b.**

Species/Stock	**Status: trend in U.S. nesting population**
Loggerhead	Threatened: overall the species is thought to be stable or slightly increasing. The northern nesting assemblage is thought to be stable or slightly declining
Leatherback	Endangered: loss of some nesting populations; possible increases in some nesting populations; overall thought to be stable at best
Green	Endangered: increasing
Kemp's Ridley	Endangered: thought to be increasing
Hawksbill	Endangered: unknown if there is a recent trend

Table 3.12 Annual Estimates of Total Marine Turtle Bycatch and the Subset that Were Dead When Released in the U.S. Pelagic Longline Fishery. Source: NOAA Fisheries, 2001b (1992-1999 data); Yeung. 2001 (2000 data); Garrison, 2003 (2001-2002 data).

Species	Loggerhead		Leatherback		Green		Hawksbill		Kemp's Ridley		Unidentified		Sum Total
Year	Total	Dead*	Total	Dead*	Total	Dead*	Total	Dead*	Total	Dead*	Total	Dead*	
1992	293	0	914	88	87	30	20	0	1	0	26	0	1,341
1993	417	9	1,054	0	31	0					31	0	1,533
1994	1,344	31	837	0	33	0			26	0	34	0	2,274
1995	2,439	0	934	0	40	0					171	0	3,584
1996	917	2	904	0	16	2					2	0	1,839
1997	384	0	308	0			16	0	22	0	47	0	777
1998	1,106	1	400	0	14	1	17	0			1	0	1,538
1999	991	23	1,012	0							66	0	2,069
2000	1,256	0	769	0							128	0	2,153
2001	312	13	1,208	0							0	0	1,520
2002	575	2	962	33							50	0	1,587
Total	10,034	81	9,302	121	221	33	53	0	49	0	556	0	20,215

* Does not account for fishing related mortality that may occur after release.

Table 3.13. Seabird Bycatch in the U.S. Atlantic Pelagic Longline Fishery, 1992-2003, taken from observer data. Source: NOAA Fisheries, 2004.

Year	Month	Area	Type of Bird	Number observed	Status
1992	10	MAB	GULL	4	dead
1992	10	MAB	SHEARWATER GREATER	2	dead
1993	2	SAB	GANNET NORTHERN	2	alive
1993	2	MAB	GANNET NORTHERN	2	alive
1993	2	MAB	GULL BLACK BACKED	1	alive
1993	2	MAB	GULL BLACK BACKED	3	dead
1993	11	MAB	GULL	1	alive
1994	6	MAB	SHEARWATER GREATER	3	dead
1994	8	MAB	SHEARWATER GREATER	1	dead
1994	11	MAB	GULL	4	dead
1994	12	MAB	GULL HERRING	7	dead
1995	7	MAB	SEA BIRD	5	dead
1995	8	GOM	SEA BIRD	1	dead
1995	10	MAB	STORM PETREL	1	dead
1995	11	NEC	GANNET NORTHERN	2	alive
1995	11	NEC	GULL	1	alive
1997	6	SAB	SEA BIRD	11	dead
1997	7	MAB	SEA BIRD	1	dead
1997	7	NEC	SEA BIRD	15	alive
1997	7	NEC	SEA BIRD	6	dead
1998	2	MAB	SEA BIRD	7	dead
1998	7	NEC	SEA BIRD	1	dead
1999	6	SAB	SEA BIRD	1	dead
2000	6	SAB	GULL LAUGHING	1	alive
2000	11	NEC	GANNET NORTHERN	1	dead
2001	6	NEC	SHEARWATER GREATER	7	dead
2001	7	NEC	SHEARWATER GREATER	1	dead
2002	7	NEC	SEABIRD	1	dead
2002	8	NED	SHEARWATER GREATER	1	dead
2002	8	NED	SEABIRD	1	dead
2002	9	NED	SHEARWATER GREATER	3	dead
2002	9	NED	SEABIRD	3	alive
2002	9	NED	SHEARWATER SPP	1	dead
2002	10	NED	GANNET NORTHERN	1	alive
2002	10	NED	SHEARWATER SPP	1	dead
2002	10	NED	SEABIRD	2	dead
2002	10	MAB	GULL	3	alive
2002	10	MAB	GULL	1	dead
2002	11	MAB	GULL	3	dead
2003	1	GOM	SEABIRD	1	alive
2003	8	NED	SEABIRD	1	dead
2003	9	MAB	SEABIRD	1	dead

MAB - Mid Atlantic Bight, SAB - South Atlantic Bight, NEC - Northeast Coastal, GOM - Gulf of Mexico, NED - Northeast Distant Water

Table 3.14. Status of Seabird Bycatch in the U.S. Atlantic Pelagic Longline Fishery, 1992-2003. Source: NMFS PLL fishery observer program (POP) data.

Species	Release Status		Total	Percent Dead
	Dead	Alive		
GULLS (incl. Blackback, Herring, Laughing, and unid. gull)	22	7	29	75.9%
UNIDENTIFIED SEABIRD	39	19	58	67.2%
GREATER SHEARWATER	18	0	18	100%
SHEARWATER SPP	2	0	2	100%
NORTHERN GANNET	1	7	8	12.5%
STORM PETREL	1	0	1	100%
ALL SEABIRDS	83	33	116	71.6%

Table 3.15. Preliminary expanded estimates of seabird bycatch and bycatch rates (D=discarded dead and A=discarded alive) in the U.S. Atlantic pelagic longline fishery, 1995-2002. Source: NOAA Fisheries, 2004.

	1995		1996		1997		1998		1999		2000		2001		2002	
Species	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**
Unid. seabirds	134	0	0	0	468	292	155	0	14	0	0	0	0	0	3	3
Gulls	0	15	0	0	0	0	0	0	0	0	0	18	0	0	14	83
Shearwaters	0	0	0	0	0	0	0	0	0	0	0	0	210	0	6	0
Northern gannet	0	30	0	0	0	0	0	0	0	0	11	0	0	0	0	1
Storm petrel	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All seabirds	170	44	0	0	468	292	155	0	14	0	11	18	210	0	23	87
Total hooks set	10,182,297		10,310,708		9,637,807		8,019,183		7,901,789		7,975,529		7,563,951		7,150,231	
Bycatch rate	0.0167	0.0044	0	0	0.0486	0.0303	0.0194	0	0.0017	0	0.0014	0.0023	0.0278	0	0.0032	0.0121

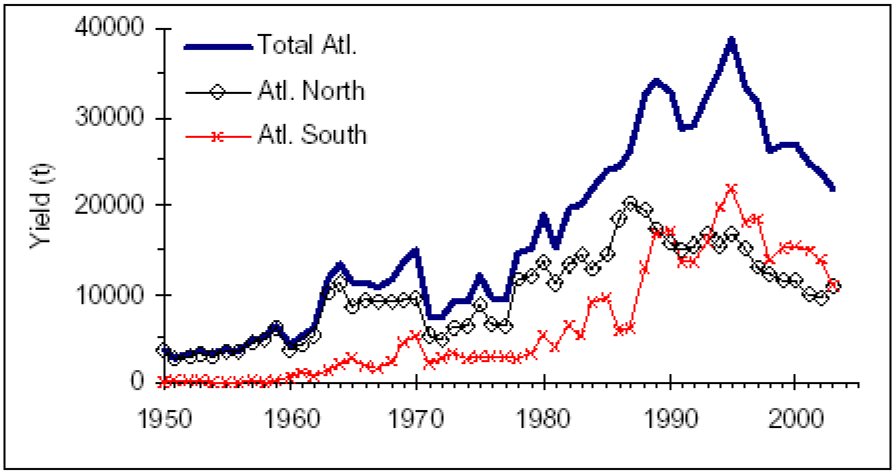

Figure 3.1. Reported catches (mt whole weight) of Atlantic Swordfish, including discards for 1950 – 2003. **Source: SCRS, 2004.**

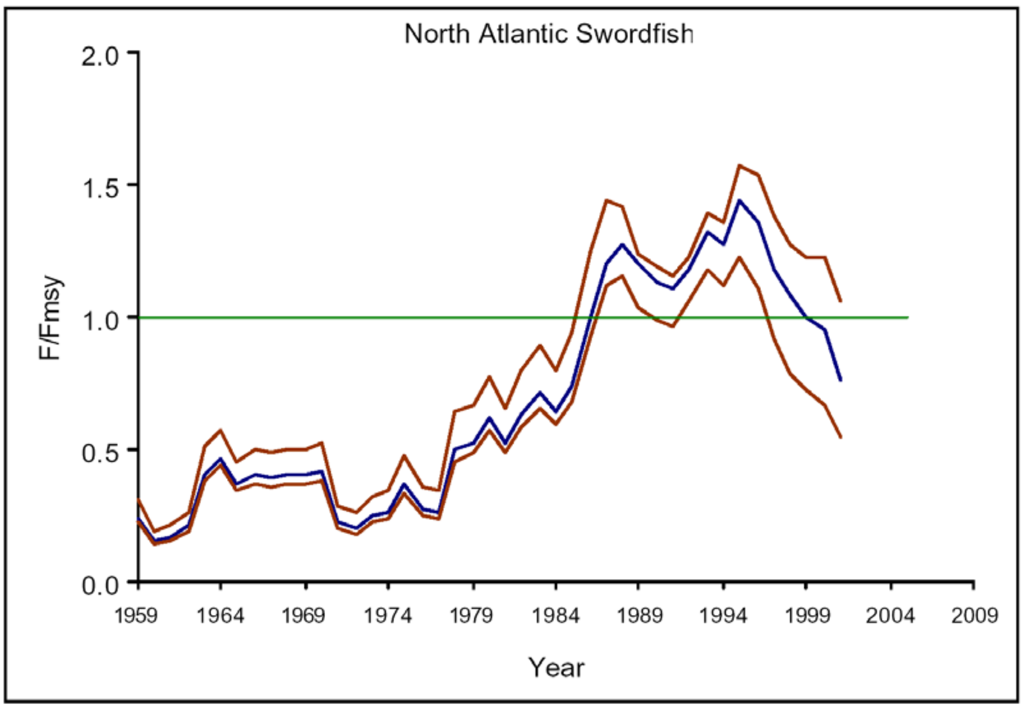

Figure 3.2. Estimated fishing mortality rate relative to FMSY (F/FMSY) for the period 1959-2001 (median with 80% confidence bounds based on bootstrapping are shown). **Source: SCRS 2004.**

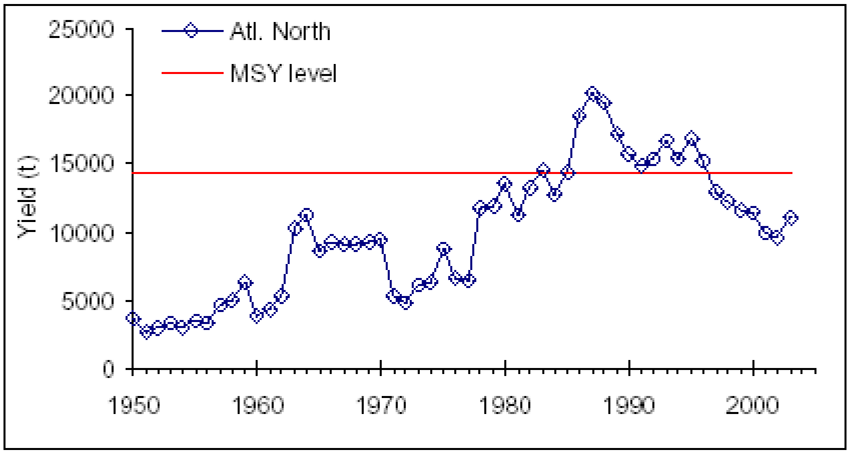

Figure 3.3. Annual yield (mt) (whole weight) for North Atlantic swordfish relative to the estimated MSY level. **Source: SCRS 2004.**

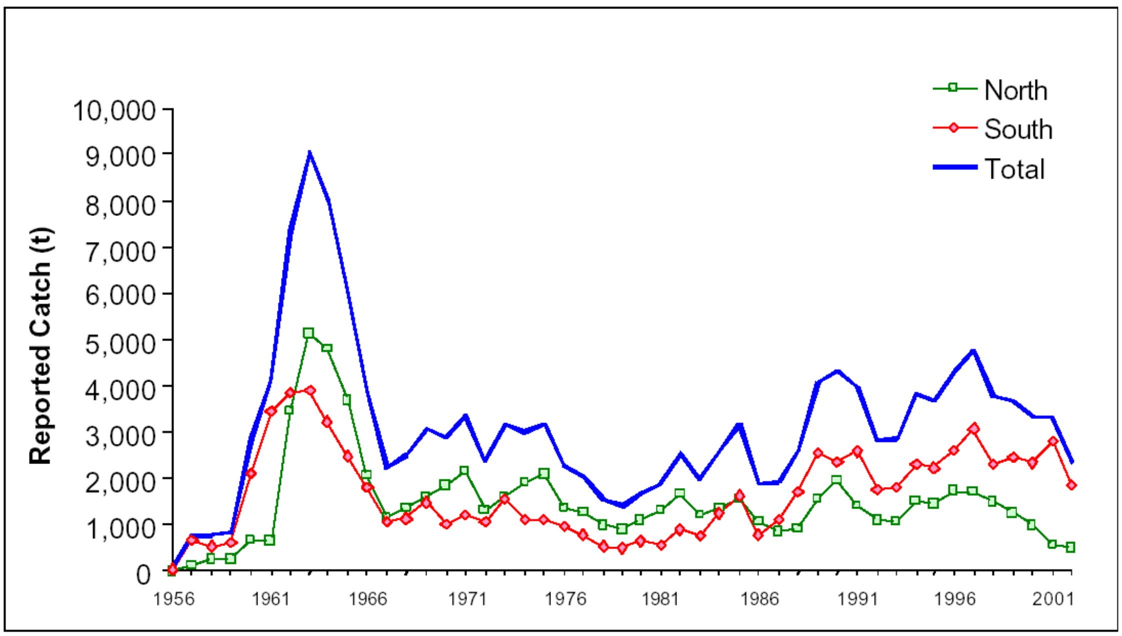

Figure 3.4. Estimated catches (including landings and dead discards in mt) of blue marlin in the Atlantic by region. The 2003 catch reported to ICCAT is preliminary and is not included in this figure. Weights are in metric tones, whole weight.

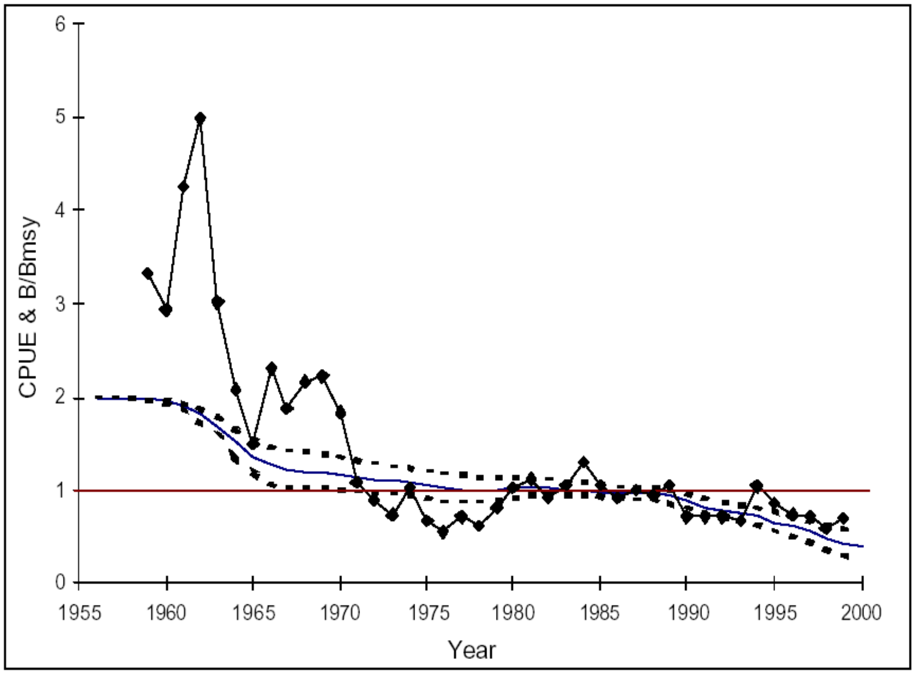

Figure 3.5. Composite CPUE series (symbols) used in the blue marlin assessment compared to model estimated median relative biomass (solid lines) from bootstrap results (80 percent confidence bounds shown by dotted lines).

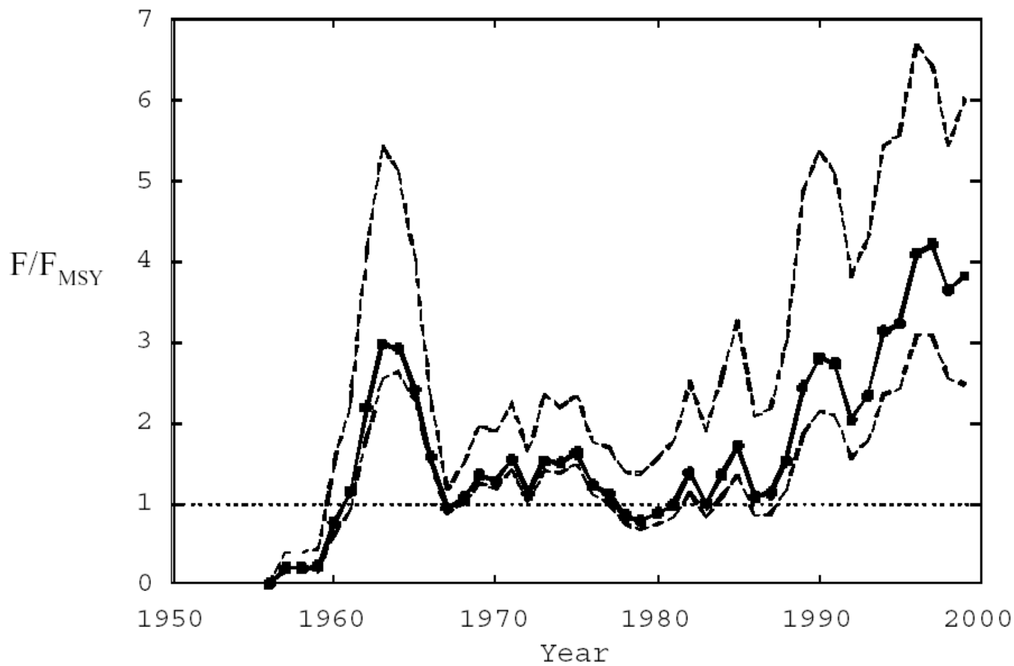

Figure 3.6. Estimated median relative fishing mortality trajectory for Atlantic blue marlin (center, dark line) with approximate 80 percent confidence range (light lines) obtained from bootstrapping.

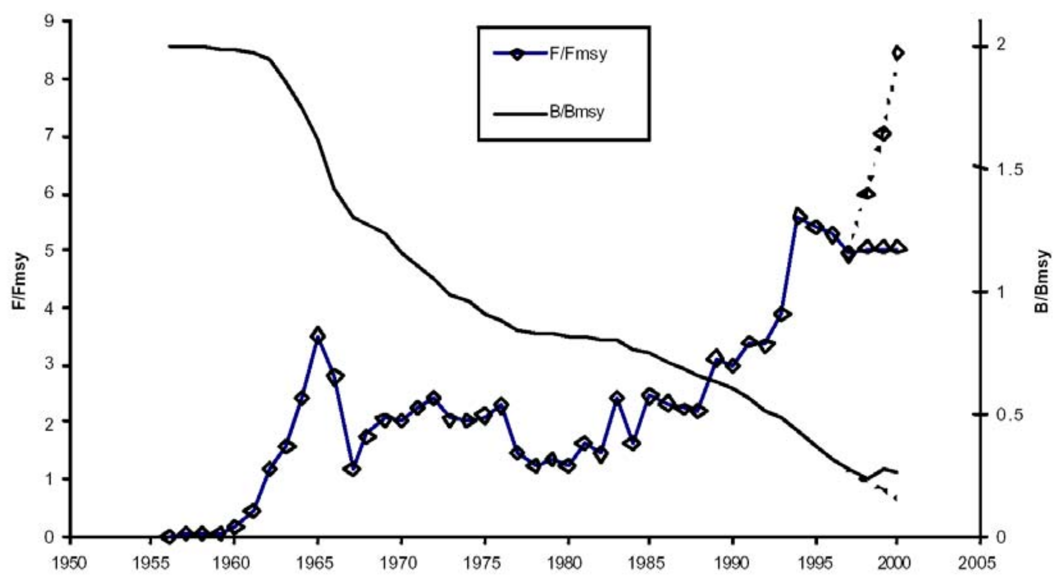

Figure 3.7. Estimated biomass ratio B2000/ BMSY (solid line, no symbols) and fishing mortality ratio F2000/FMSY (solid line with symbols) from the production model fitted to the continuity case for white marlin. Ratios of last three years have been adjusted for retrospective pattern. Broken lines show unadjusted ratios. Note that scales are different for each ratio. **Source: SCRS, 2004.**

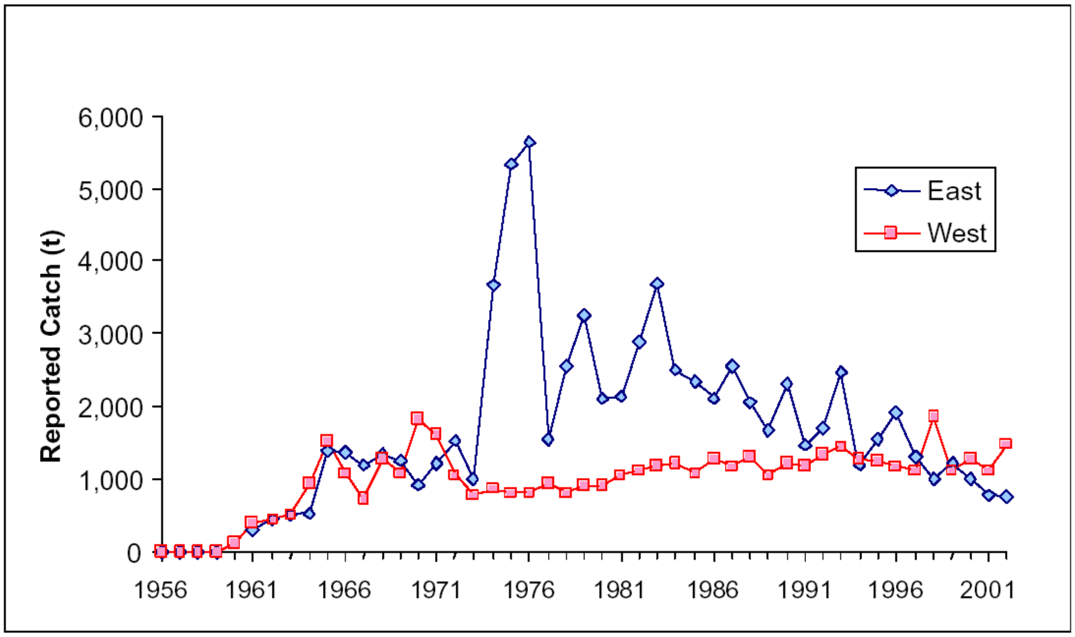

Figure 3.8. Evolution of estimated sailfish/spearfish catches in the Atlantic (landings and dead discards, reported and carried over) in the ICCAT Task I database during 1956-2002 for the east and west stocks. The 2003 catch reported to ICCAT is preliminary and is not included in this figure. Weights are in metric tons, whole weight.

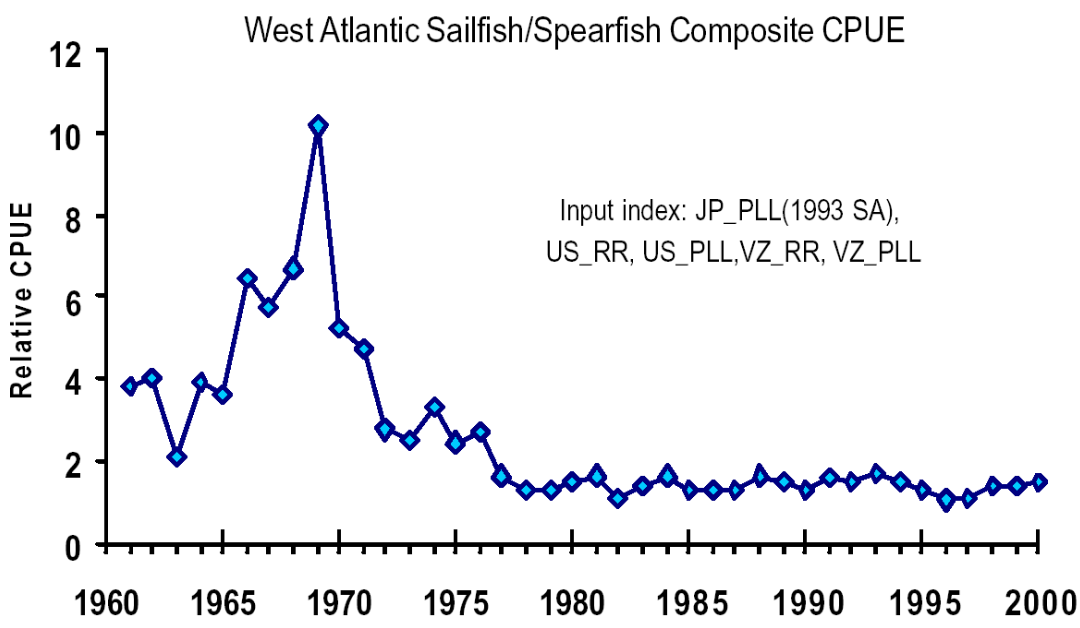

Figure 3.9. Available standardized CPUE for western Atlantic sailfish/spearfish for the period 1967-2000, including Japanese, U.S., and Venezuelan time series data.

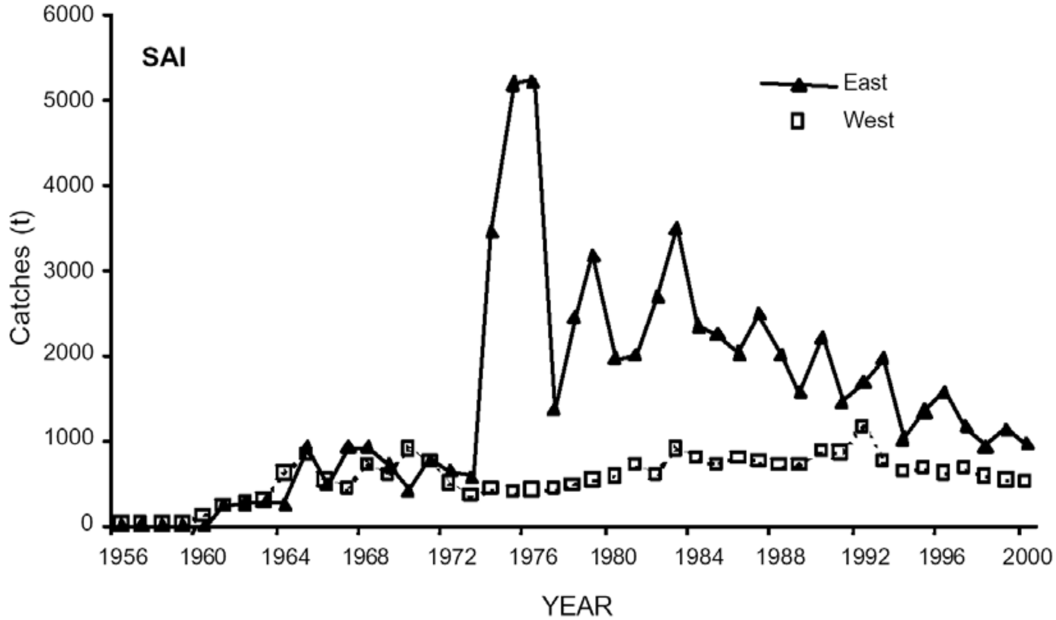

Figure 3.10. Estimated sailfish "only" catches based on the new procedure for splitting combined sailfish and longbill spearfish catches from 1956-2000. Weights are in metric tons, whole weight.

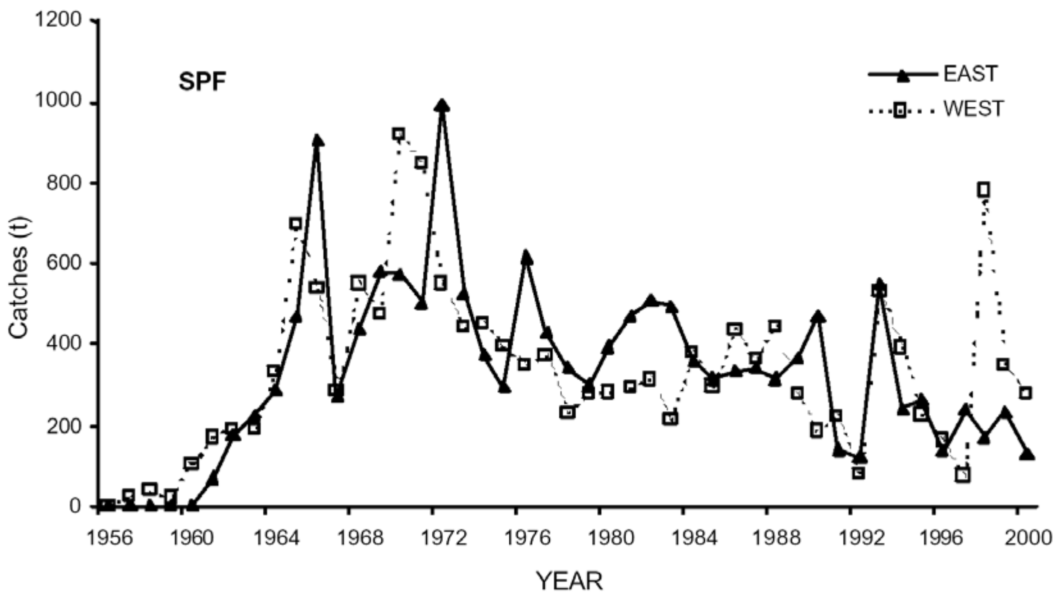

Figure 3.11. Estimated spearfish "only" catches in the Atlantic based on the new procedure for splitting combined sailfish and spearfish catches from 1956-2000. Weights are in metric tons, whole weight.

a)

b)

c)

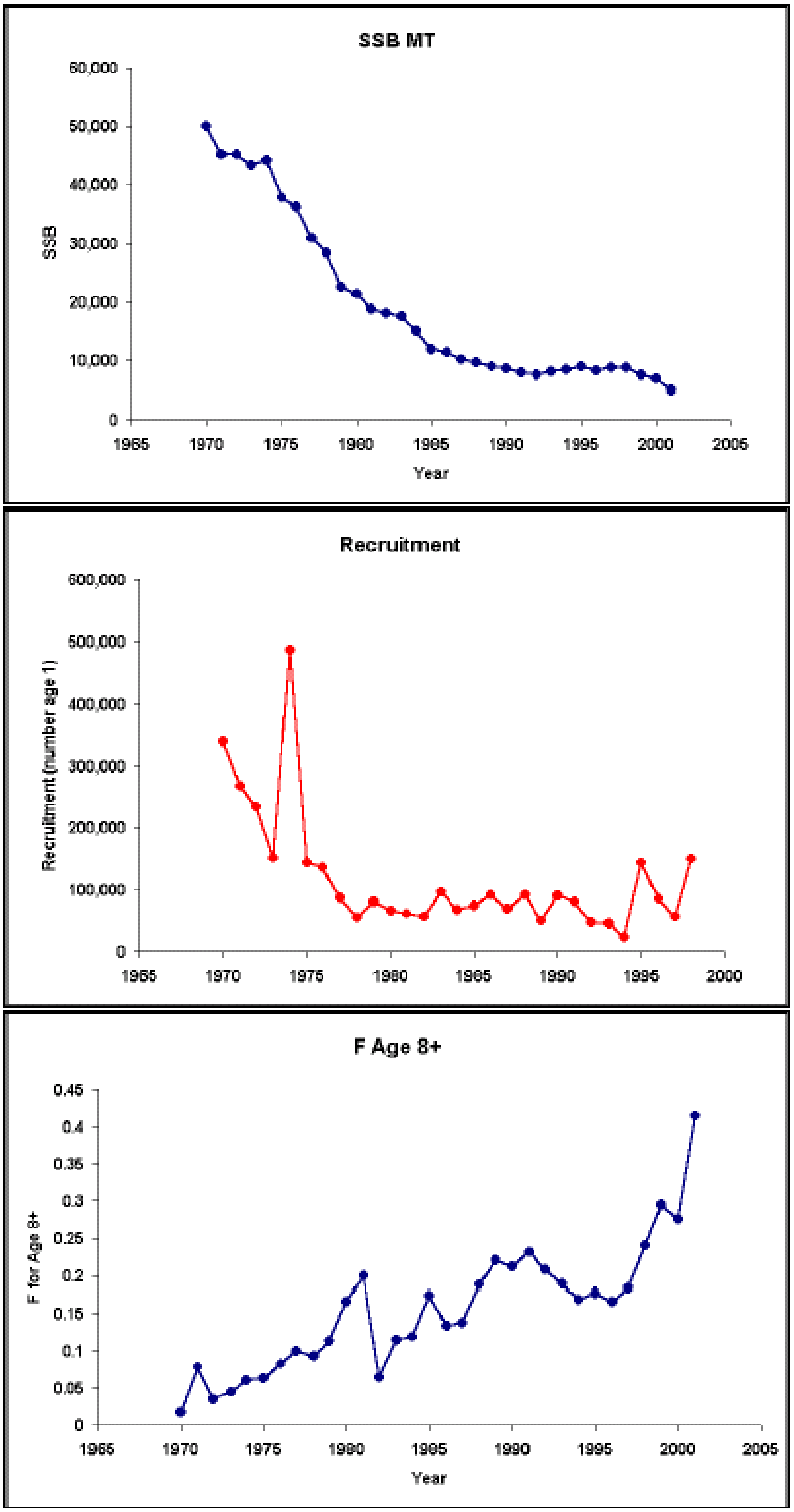

Figure 3.12. West Atlantic bluefin tuna spawning biomass (t), recruitment (numbers) and fishing mortality rates for fish of age 8+ , estimated by the Base Case VPA run.

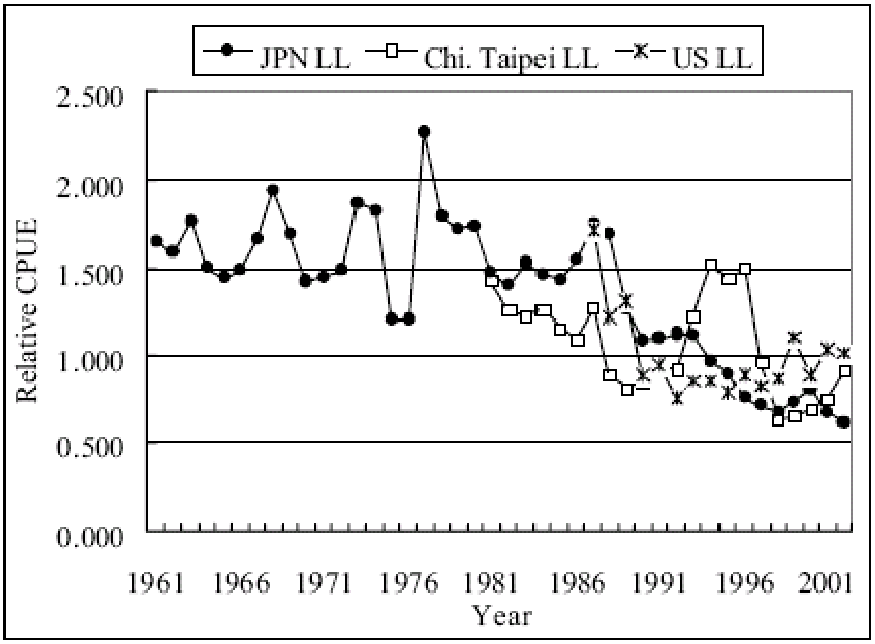

Figure 3.13. Abundance indices in numbers of BET. All ages are aggregated.

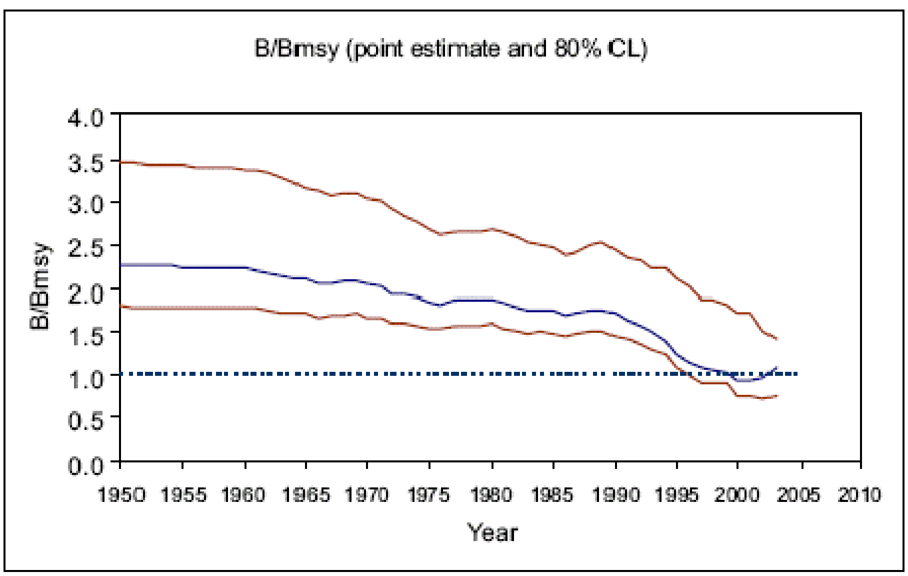

Figure 3.14. Trajectory of the BET biomass modeled in production model analysis (middle line) bounded by upper and lower lines denoting 80 percent confidence intervals.

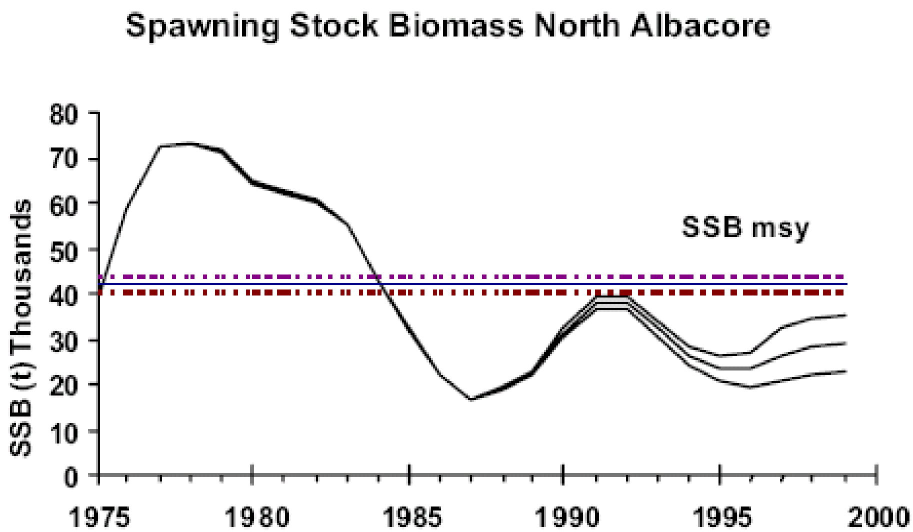

Figure 3.15. North Atlantic albacore spawning stock biomass and recruits with 80 percent confidence limits.

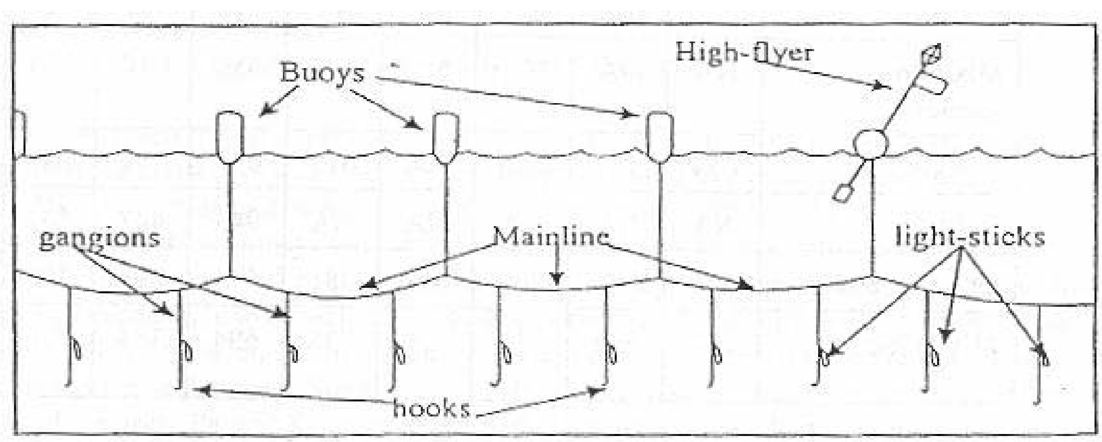

Figure 3.16. Typical U.S. Pelagic Longline Gear. **Source: Arocha, 1996.**

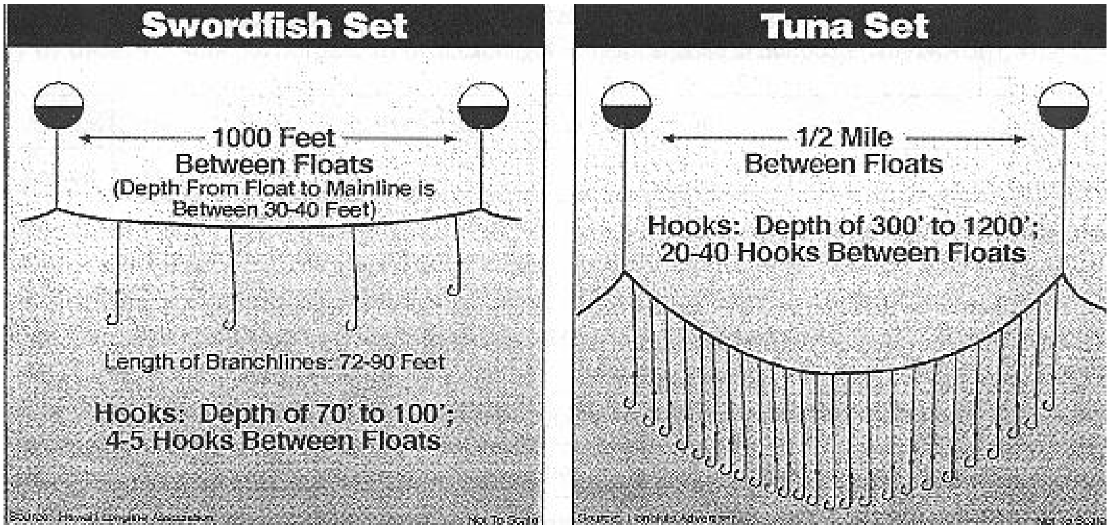

Figure 3.17. Different Pelagic Longline Gear Deployment Techniques. **Source: Hawaii Longline Association and Honolulu Advertiser.**

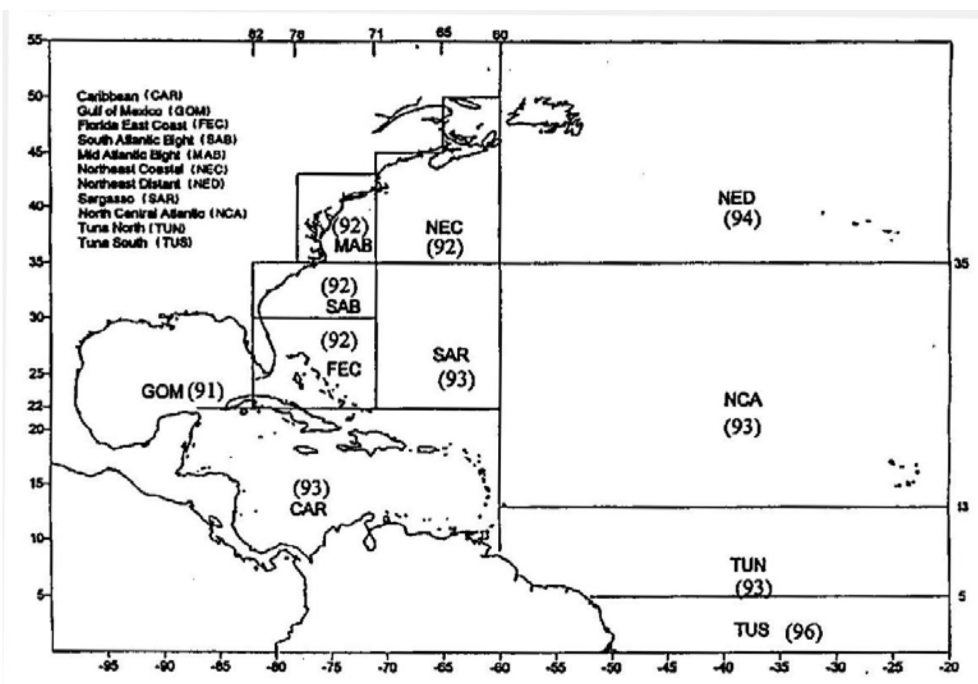

Figure 3.18. Geographic Areas Used in Summaries of Pelagic Logbook Data. Number of turtles captures are shown in parentheses. **Source: Cramer and Adams, 2000.**

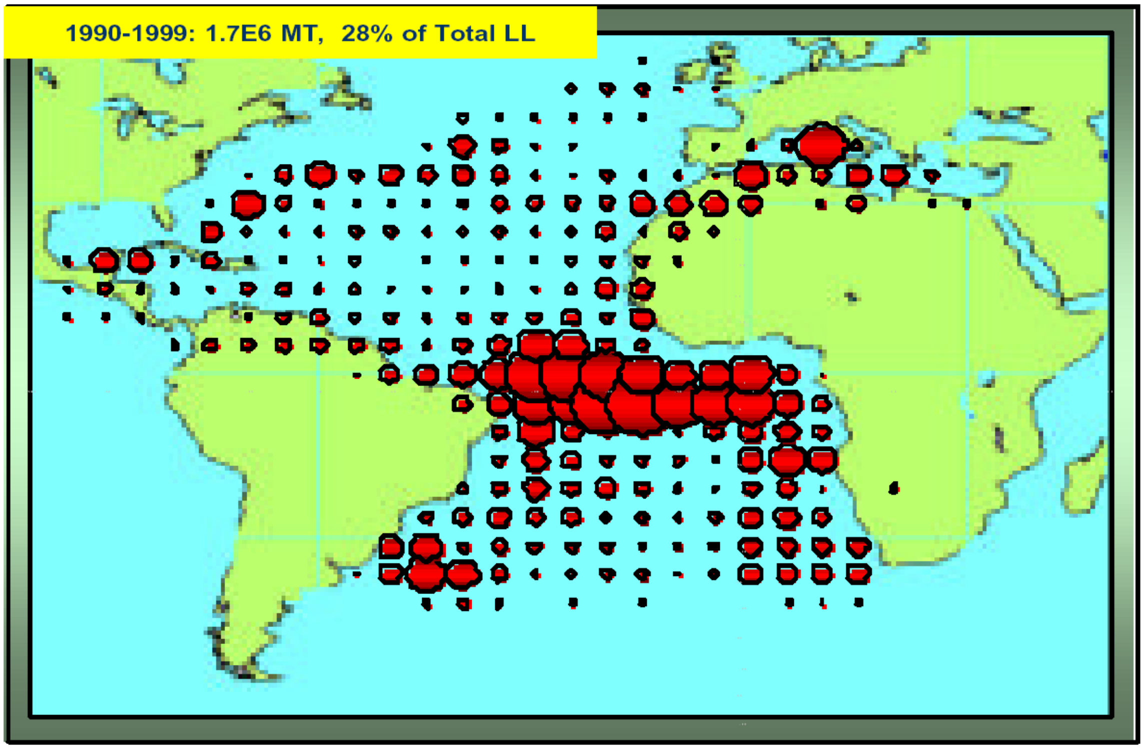

Figure 3.19. Distribution of Atlantic Longline Catches for all Countries 1990-1999. Source: SCRS, 2004.

4.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES CONSIDERED

The environmental, social, and economic consequences of the alternatives considered are described below and in Chapters 6.0, 7.0, and 8.0.

4.1 Specifically Authorized Activities Alternatives

The Fisheries Research Institute (FRI) has submitted three separate exempted fishing permit (EFP) applications on behalf of six pelagic longline vessels to evaluate bycatch reduction technology in the Gulf of Mexico, Florida East Coast, South Atlantic Bight, Mid-Atlantic Bight, and Northeast Coastal statistical areas of the Atlantic Ocean. The EFPs are necessary to support a Cooperative Research Proposal submitted by the Fisheries Research Institute in partnership with the NMFS Southeast Fisheries Science Center, College of William and Mary, Virginia Institute of Marine Science, School of Marine Science, and the University of California, Santa Cruz Long Marine Lab.

Research is proposed within, under restricted access, and outside of existing closed areas. To conclusively demonstrate effectiveness, in the shortest time frame, this research will need to test bycatch reduction measures in those areas (i.e., closed areas) where pelagic longlines are most likely to encounter the bycatch species of concern (i.e., HMS species). Research within the closed areas is necessary to compare control and treatment catches/species composition to historic catch information.

4.2 Exempted Fishing Permits

As described in Chapter 2, the alternatives considered for exempted fishing permits are:

1: Deny EFP applications to conduct scientific research in closed regions of the Gulf of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean – NO ACTION

2: Authorize exempted fishing permits to conduct scientific research in closed regions of the Gulf of Mexico (GOM) statistical areas of the Atlantic Ocean, as requested by FRI

3: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Gulf of Mexico (GOM) statistical areas of the Atlantic Ocean, as modified by NMFS to include a no sale provision beyond the existing commercial retention limits (i.e., 2 swordfish) for incidental permit holders conducting research in the DeSoto Canyon closed area – Preferred Alternative*

4: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Florida East Coast (FEC) and South Atlantic Bight (SAB) statistical areas of the Atlantic Ocean, as requested by FRI – Preferred Alternative*

5: *Authorize exempted fishing permits to conduct scientific research in closed regions of the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean, as requested by FRI – Preferred Alternative*

Alternatives 3, 4, and 5 are the preferred alternatives.

Ecological Impacts

Alternative 1 (no action) would deny EFP applications to conduct scientific research in closed regions of the GOM, FEC, SAB, MAB, and NEC statistical areas of the Atlantic Ocean and maintain existing regulations, which prohibit PLL in these closed areas. These closed areas were implemented in 1999 (MAB/NEC closure), 2000 (GOM closure), and 2001 (FEC/SAB closure) to effectively reduce bycatch of undersized HMS (i.e., swordfish and bluefin tuna) in pelagic longline fisheries.

While these closures continue to serve as an effective management tool to reduce bycatch of HMS in these regions, they can also inadvertently serve as barriers to bycatch reduction research. By denying the EFP applications, which rely on activities in closed areas, research could not be conducted efficiently and it would be difficult to demonstrate the effectiveness of bycatch reduction methods or gear technologies.

Alternative 2 would authorize exempted fishing permits to conduct scientific research in closed regions of the Gulf of Mexico (GOM) statistical areas of the Atlantic Ocean, as requested by FRI. The proposed activity is limited in both scope and magnitude. The EFP application stipulates that fishing activities would be limited to a total of two, domestic, pelagic longline vessels for a period not to exceed six months. The number of sets will be limited to a maximum of 50 sets per vessel within the DeSoto Canyon closed area and the number of hooks will be limited to approximately 750 hooks per set. Additionally, access to the closed area will be restricted to offshore of the 250 fathom depth contour. Data from the GOM closed area would only account for 50 percent of the total data anticipated for collection. The remaining 50 percent would come from research in other areas as requested by FRI and outlined in alternatives 4 (25%) and 5 (25%).

Participating vessels would be fishing in open areas if they were not allowed to participate in this research project. While one of the participating vessels holds an incidental swordfish permit and it is possible that mortality on sexually mature swordfish could increase if this vessel is allowed to retain and sell more than the incidental limit (i.e., two swordfish per trip), the experimental design for this scientific research stipulates that this vessel will direct only on yellowfin tuna. Based upon a NMFS review of the historical catch associated with these vessels, relatively few incidental catches of swordfish are expected to occur during the course of this research. Therefore, NMFS does not anticipate an increase in fishing effort as part of this proposed activity. These same fishing vessels would likely encounter similar species composition and bycatch if fishing under normal circumstances as compared with that of the proposed activity.

Historically, the directed and incidental fishery quotas for swordfish have not been taken. This has resulted in substantial carryovers from previous fishing years. As of January 31, 2005, only 35 percent, seven percent, and two percent of the first semi-annual season's, second semi-annual season's, and incidental fishery's quotas, for North Atlantic Swordfish had been taken respectively (See Table 4.1). Given that these vessels would be fishing in open areas if they were not participating in this scientific research, NMFS does not anticipate that the quota for swordfish would be exceeded as a result of permitting this activity. All catches from this proposed activity would be monitored and counted against the appropriate quotas.

The DeSoto canyon was closed in November 2000 to avoid/reduce bycatch of juvenile swordfish caught by fishermen using pelagic longline fishing gear. Two vessels directing on yellowfin tuna for six months while fishing their yellowfin tuna baits at a minimum of a 45 fathom depth are not expected to have substantial catches of juvenile swordfish due to the few incidental captures of swordfish on these directed trips. Historical catch data from the Pelagic Observer Program (POP) from 2001 through 2003 indicates that a total of 21.1 metric tons (mt) of swordfish were caught in the Gulf of Mexico during the six month time period for planned research (See Table 4.2). Taking into consideration that PLL fishermen were using J-style hooks during this time period, and based upon anticipated changes in bycatch levels as a result of new regulatory requirements to utilize circle hooks in the PLL fishery, the projected catch of swordfish, under the auspices of an EFP, in the GOM ranges from 10.7 to 20.6 mt, depending upon the hook and bait combination employed (See Table 4.3).

During a recent Endangered Species Act (ESA) consultation for the pelagic longline fishery, NMFS considered issuance of exempted fishing permits as part of the consultation. The resulting Biological Opinion specified that takes of sea turtles, under the auspices of an EFP, would be included against the authorized take levels for the pelagic longline fishery (NOAA Fisheries, 2004b). Historical catch data from the Pelagic Observer Program (POP) from 2001 through 2003 indicates that a total of 10.2 loggerhead and 2.9 leatherback sea turtles were caught in the Gulf of Mexico during the six month time period for planned research (See Table 4.2). Taking into consideration that PLL fishermen were using J-style hooks during this time period, and based upon anticipated changes (i.e., 50%) in bycatch levels as a result of new regulatory requirements to utilize circle hooks in the PLL fishery, the projected total catch of loggerhead and leatherback sea turtles, under the auspices of an EFP, in the GOM ranges from 3.7 to 5.1 leatherback turtles and 0.4 to 4.8 loggerhead turtles depending upon the hook and bait combination employed (See Table 4.3).

If this research proves that the gear modifications and/or fishing techniques tested reduce bycatch and associated regulatory discards of juvenile HMS, other target and non-targeted finfish in the regions of concern, then this information could be incorporated into future rulemaking to implement bycatch and bycatch mortality reduction measures for HMS and other species caught during normal fishing operations. For protected sea turtles, this research would provide further information on circle hook and bait treatments for warm water regions. This information could then be transferred to other countries with similar concerns.

Alternative 3 would result in similar ecological impacts to that of Alternative 2, with the exception that Alternative 3 would prohibit the sale of legal sized swordfish beyond the existing commercial retention limits (i.e., 2 swordfish), for one of the participating vessels with an incidental permit. Under existing regulations, incidental permit holders are limited to retention and sale of two swordfish per trip. This alternative may mitigate concerns relating to increased mortality on sexually mature swordfish by prohibiting retention and sale beyond that which is currently allowed under existing regulations.

Alternative 4 would authorize exempted fishing permits to conduct scientific research in closed regions of the Florida East Coast (FEC) and South Atlantic Bight (SAB) statistical areas of the Atlantic Ocean. The proposed activity is limited in both scope and magnitude. The EFP application stipulates that fishing activities would be limited to a total of two, domestic, pelagic longline vessels for a period not to exceed three months. The number of sets will be limited to a maximum of 12 sets per vessel within the east coast of Florida closed area and the number of hooks will be limited to approximately 556 hooks per set. Additionally, access to the closed areas will be restricted such that the area between 24° (southern boundary of closed area South of Key West, FL) and 27° 45' North Latitude would be restricted to offshore of the "Axis" of the Gulf Stream as printed on NOAA Chart #411. Data from the east coast of Florida closure would account for 25 percent of the total data anticipated for collection. The remaining 75 percent would come from research in other areas as requested by FRI and outlined in alternatives 2/3 (50%) and 5 (25%).

Participating vessels would be fishing in open areas if they were not allowed to participate in this research project. Therefore, NMFS does not anticipate an increase in fishing effort as part of this proposed activity. These same fishing vessels would likely encounter similar species composition and bycatch if fishing under normal circumstances as compared with that of the proposed activity.

Historically, the directed and incidental fishery quotas for swordfish have not been taken. This has resulted in substantial carryovers from previous fishing years. As of January 31, 2005, only 35 percent, seven percent, and two percent of the first semi-annual season's, second semi-annual season's, and incidental fishery's quotas, for North Atlantic Swordfish had been taken respectively (See Table 4.1). Given that these vessels would be fishing in open areas if they were not participating in this scientific research, NMFS does not anticipate that the quota for swordfish would be exceeded as a result of permitting this activity. All catches from this proposed activity would be monitored and counted against the appropriate quotas.

Since 2001, fishermen from the United States have been prohibited from fishing pelagic longline in sub-regions of the FEC and SAB because of concerns surrounding bycatch of juvenile swordfish. Two vessels directing on swordfish and fishing from late April into early May is not expected to have substantial catches of juvenile swordfish due to the few incidental captures of swordfish on these directed trips. Historical catch data from the Pelagic Observer Program (POP) from 2001 through 2003 indicates that a total of 27 metric tons (mt) of swordfish were caught in the South of Hatteras region during the three month time period for planned research (See Table 4.2). Taking into consideration that PLL fishermen were using J-style hooks during this time period, and based upon anticipated changes in bycatch levels as a result of new regulatory requirements to utilize circle hooks in the PLL fishery, the projected total catch of swordfish, under the auspices of an EFP, in the South of Hatteras region ranges from 13.7 to 26.4 mt depending upon the hook and bait combination employed (See Table 4.3).

During a recent ESA consultation regarding the pelagic longline fishery, NMFS considered the issuance of exempted fishing permits in the consultation. The resulting Biological Opinion specified that takes of sea turtles, under the auspices of an EFP, would be included against the authorized take levels for the pelagic longline fishery (NOAA Fisheries, 2004b). Historical catch data from the Pelagic Observer Program (POP) from 2001 through 2003 indicates that a total of 13.8 loggerhead and 4.8 leatherback sea turtles were caught in the South of Hatteras region during the three-month time period for planned research (See Table 4.2). Taking into consideration that PLL fishermen were using J-style hooks during this time period, and based upon anticipated changes in bycatch levels as a result of new regulatory requirements to utilize circle hooks in the PLL fishery, the projected catch of loggerhead and leatherback sea turtles, under the auspices of an EFP, in the South of Hatteras region ranges from 5 to 6.9 leatherback turtles and 0.7 to 7.8 loggerhead turtles depending upon the hook and bait combination employed (See Table 4.3).

If this research proves that the gear modifications and/or fishing techniques tested reduce bycatch and associated regulatory discards of juvenile HMS, other target and non-targeted finfish in the regions of concern, then this information could be incorporated into future rulemaking to implement bycatch and bycatch mortality reduction measures for HMS and other species caught during normal fishing operations. For protected sea turtles, this research would provide further information on circle hook and bait treatments for warm water regions. This information could then be transferred to other countries with similar concerns.

Alternative 5 would authorize exempted fishing permits to conduct scientific research in closed regions of the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean. The proposed activity is limited in both scope and magnitude. The EFP application stipulates that fishing activities would be limited to a total of two, domestic, pelagic longline vessels for a period not to exceed three months. The number of sets will be limited to a maximum of 12 sets per vessel within the June MAB/NEC closed area and the number of hooks will be limited to approximately 680 hooks per set. Additionally, access to the closed area will be restricted to offshore of the 250 fathom depth contour. Data from the June MAB/NEC closure would account for 25 percent of the total data anticipated for collection. The remaining 75 percent would come from research in other areas as requested by FRI and outlined in alternatives 2/3 (50%) and 4 (25%).

Participating vessels would be fishing in open areas if they were not allowed to participate in this research project. Therefore, NMFS does not anticipate an increase in fishing effort as part of this proposed activity. These same fishing vessels would likely encounter similar species composition and bycatch if fishing under normal circumstances as compared with that of the proposed activity.

Historically, the directed and incidental fishery quotas for swordfish have not been taken. This has resulted in substantial carryovers from previous fishing years. As of January 31, 2005, only 35 percent, seven percent, and two percent of the first semi-annual season's, second semi-annual season's, and incidental fishery's quotas, for North Atlantic Swordfish had been taken respectively (See Table 4.1). Given that these vessels would be fishing in open areas if they were not participating in this scientific research, NMFS does not anticipate that the quota for swordfish would be exceeded as a result of permitting this activity. All catches from this proposed activity would be monitored and counted against the appropriate quotas.

Since 1999, fishermen from the United States have been prohibited from fishing pelagic longline in sub-regions of the MAB and NEC during the month of June because of concerns surrounding bycatch of Bluefin tuna. Two vessels directing on bigeye tuna or swordfish for one month during the existing closure is not expected to have substantial catches of bluefin tuna or juvenile swordfish due to the few incidental captures of bluefin tuna/swordfish on these directed trips. Historical catch data from the Pelagic Observer Program (POP) from 2001 through 2003 indicates that a total of 5.1 metric tons (mt) of bluefin tuna and 5.6 mt of swordfish were caught in the North of Cape Hatteras region during the three month time period for planned research (See Table 4.2). Dead discards of bluefin tuna and swordfish for this region and three-month time period were around 3.7 mt and 1.3 mt respectively (See Table 4.2). Catch estimates for Bluefin tuna and swordfish during the June closure are somewhat lower that the catches for the full three-month research period at 4.5 and 1.2 mt respectively.

During a recent ESA consultation regarding the pelagic longline fishery, NMFS considered the issuance of exempted fishing permits in the consultation. The resulting Biological Opinion specified that takes of sea turtles, under the auspices of an EFP, would be included against the authorized take levels for the pelagic longline fishery (NOAA Fisheries, 2004b). Historical catch data from the Pelagic Observer Program (POP) from 2001 through 2003 indicates that a total of 2.4 loggerhead and 4.3 leatherback sea turtles were caught in the North of Cape Hatteras region during the three-month time period for planned research (See Table 4.2). Taking into consideration that PLL fishermen were using J-style hooks during this time period, and based upon anticipated changes in bycatch levels as a result of new regulatory requirements to utilize circle hooks in the PLL fishery, the projected catch of loggerhead and leatherback sea turtles, under the auspices of an EFP, in the North of Cape Hatteras region range from 2.1 to 0.9 leatherback turtles and 0.6 to 7.1 loggerhead turtles depending upon the hook and bait combination employed (See Table 4.3).

If this research proves that the gear modifications and/or fishing techniques tested reduce bycatch and associated regulatory discards of juvenile HMS, other target and non-targeted finfish in the regions of concern, then this information could be incorporated into future rulemaking to implement bycatch and bycatch mortality reduction measures for HMS and other species caught during normal fishing operations. For protected sea turtles, this research would provide further information on circle hook and bait treatments for warm water regions. This information could then be transferred to other countries with similar concerns.

Social and Economic Impacts

Alternative 1 is not anticipated to result in any social or economic impacts. However, Alternative 1 may create a disincentive for future cooperative research ventures between regulatory agencies and industry representatives. Approval of EFPs would allow for donation of undersized fish caught during exempted fishing operations. Alternative 1 would not provide the opportunity for additional donations of HMS to national food banks.

Alternatives 2, 3, 4, and 5 may create incentives for future cooperative research ventures between regulatory agencies and industry representatives if such research is perceived as useful for reducing bycatch in areas where regulatory discards are high and if the information gained is transferred to other countries with similar concerns regarding transboundary species. While administrative costs to the agency are higher, in terms of monitoring (i.e., 100% observer coverage as a term and condition of permit) and enforcing exempted fishing activities under Alternatives 2, 3, 4, and 5, the benefits gained from technological advances in bycatch and bycatch mortality reduction, both to the fishery and to the regulatory agency, far out way the costs administrative costs incurred.

Additional information pertaining to the economic impacts associated with Alternatives 1, 2, 3, 4, and 5 is provided in Chapter 6 of this document.

Conclusion

NMFS does not anticipate that any of the preferred alternatives either individually or cumulatively will result in significant ecological, social, or economic impacts.

4.2 Impacts on Essential Fish Habitat

The measures in this action would mostly impact fishing inside the U.S. Exclusive Economic Zone (EEZ). Although fishing location is changing as a result of the proposed activity, NMFS does not anticipate any impacts to essential fish habitat.

4.3 Impacts on Other Finfish Species

Approval of these EFPs is not expected to significantly alter U.S. fishing practices or effort and therefore should not have any impact on other finfish species that have not already been considered in the HMS FMP or the supplemental environmental impact statements finalized since then.

4.4 Impacts on Protected Species Listed under the Endangered Species Act or Marine Mammal Protection Act

The alternatives considered are not expected to alter U.S. fishing effort. As noted earlier, the June 1, 2004, BiOp established incidental take statements for leatherback and loggerhead sea turtles and implemented measures designed to reduce sea turtle interactions and mortalities. Additionally the BiOp concluded that pelagic longlines are not likely to adversely affect marine mammals. NMFS is in the process of complying with the terms of the BiOp in other rulemakings. Protected resource interactions that take place under the auspices of these exempted fishing permits will be documented and counted against the appropriate incidental take statements.

4.5 Environmental Justice Concerns

Executive Order 12898 requires that federal actions address environmental justice in the decision-making process. In particular, the environmental effects of the actions should not have a disproportionate effect on minority and low-income communities. The approval of the exempted fishing permits in this document would not have any effects on human health. Additionally, the exempted fishing permits are not expected to have any social or economic effects and should not have a disproportionate effect on minority and low-income communities.

4.6 Coastal Zone Management Act Concerns

NMFS has determined that the alternatives considered in this EA will be implemented in a manner consistent to the maximum extent practicable with the enforceable policies of those Atlantic, Gulf of Mexico, and Caribbean coastal states that have approved coastal zone management programs. The regulations pertaining to issuance of exempted fishing permits were submitted to the responsible state agencies for their review under Section 307 of the Coastal Zone Management Act. All of the states that responded found NMFS' proposed actions to be consistent with their coastal zone management programs. Concurrence is presumed for those states that did not respond.

4.7 Comparison of Alternatives

NMFS does not anticipate that any of the preferred alternatives either individually or cumulatively will result in significant ecological, social, or economic impacts. See Table 4.4 for a comparison of alternatives.

4.8 Cumulative Impacts of the Alternatives

On May 28, 1999, NMFS published a final rule (64 FR 29090) that implemented the HMS FMP and Amendment One to the Atlantic Billfish FMP, and that consolidated regulations for Atlantic HMS into one C.F.R. part. The Final Environmental Impact Statements (FEIS) associated with these FMPs addressed the rebuilding and ongoing management of Atlantic tunas, swordfish, sharks, and billfish. Alternatives to rebuild and manage the Atlantic swordfish and tuna fisheries included, among other things, quotas levels, retention and size limits, upgrading restrictions, overharvest and underharvest adjustment authority, time/area closures, and permitting and reporting requirements, including a limited access system. The HMS FMP concluded that the cumulative long-term impacts of these and other management measures would be to rebuild overfished fisheries, minimize bycatch and bycatch mortality, to the extent practicable; identify and protect essential fish habitat; and minimize adverse impacts of fisheries regulations on fishing communities, to the extent practicable.

Since the HMS FMP, NMFS has finalized three supplemental environmental impact statements that affect pelagic longline fishing. The first one, published in June 2000, analyzed management measures, particularly time area closures, to reduce bycatch, bycatch mortality, and incidental catch in the pelagic longline fishery. The final actions were expected to have negative direct, indirect, and cumulative economic and social impacts for pelagic longline fishermen and were expected to have positive benefits regarding reduction in bycatch and bycatch mortality.

The second supplemental environmental impact statement, published in July 2002, implemented the measures in a June 14, 2001, Biological Opinion addressing of sea turtle bycatch and bycatch mortality in HMS fisheries. Certain measures in this rulemaking, such as the closure of the Northeast Distant Area (NED) to pelagic longline vessels, were expected to have negative direct, indirect, and cumulative economic and social impacts on pelagic longline fishermen, that were mitigated in the short-term for vessels that participated in an experimental fishery in the NED. Other measures, such as requiring gangions to be 10 percent longer than floatlines, requiring the use of corrodible, non-stainless steel hooks, reporting lethal sea turtle takes within 48 hours, and posting sea turtle handling and release guidelines in the wheelhouse were not expected to have serious impacts.

The third supplemental environmental impact statement, published on July 6, 2004 (69 FR 40734), to implement measures intended to reduce sea turtle interactions in the pelagic longline fishery. The June 2004 BiOp associated with this action found that the continued operation of the fishery was not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles, but was likely to jeopardize the continued existence of leatherback sea turtles. The BiOp established incidental take statements for leatherback and loggerhead sea turtles and implemented measures designed to reduce sea turtle interactions and mortalities in compliance with the ESA and other applicable law. The authorization of this scientific research is not expected to change interactions with protected species or result in significant cumulative impacts in addition to those previously analyzed.

NMFS is in the process of creating an amendment to the FMP that may address numerous HMS management issues such as quota distribution, streamlining the limited access program, and essential fish habitat. The Notice of Availability of an Issues and Options paper published on April 30, 2004 (69 FR 23730) with public comments being received until July 14, 2004. NMFS is currently consulting with the regional fishery management councils and the HMS/Billfish Advisory Panels for the forthcoming amendment and rulemaking.

Taking into consideration the HMS FMP and its forthcoming amendment, the various bycatch and time area closure rules, the July 2002 rule implementing the BiOp measures, and the recent sea turtle bycatch mitigation rule and associated BiOp for the pelagic longline fishery, NMFS expects no adverse significant cumulative impacts from the preferred alternatives outlined above.

Table 4.1 Landings and Remaining Quota for North Atlantic Swordfish (as of January 31, 2005). Source: 69 FR 68090.

	Quota mt dw	Landings		Remaining Quota		Percent of Quota Taken
		mt dw	lbs dw	mt dw	lbs dw	
Directed Fishery: FIRST SEMI-ANNUAL season (June 1 - November 30, 2004)	2,517.5	872.5	1,923,481	1,645.0	3,626,600	35%
Directed Fishery: SECOND SEMI-ANNUAL Season (Dec 1, 2004 - May 31, 2005)	2,517.5	187.1	412,524	2,330.4	5,137,557	7%
Incidental Fishery (annual quota)	300	5.0	10,948	299.5	650,432	2%

Table 4.2 Observed Catch Extrapolations by Area. Source: Pelagic Observer Program data 2001-2003.

Species	Gulf of Mexico			South of Cape Hatteras			North of Cape Hatteras		
	#'s	Pounds	Metric Tons	#'s	Pounds	Metric Tons	#'s	Pounds	Metric Tons
SWO caught	605.4	46554.0	21.1	774.5	59555.8	27.0	161.3	12402.7	5.6
SWO dd	299.3	23019.9	10.4	252.7	19433.2	8.8	36.7	2824.4	1.3
BFT caught	16.8	6860.3	3.1	80.4	32900.8	14.9	27.3	11154.0	5.1
BFT dd	8.3	3377.5	1.5	49.6	20300.4	9.2	19.7	8065.5	3.7
ALB caught	1.0	38.1	0.0	31.1	1193.7	0.5	30.8	1180.2	0.5
BET caught	12.5	723.7	0.3	59.1	3409.0	1.5	56.5	3262.2	1.5
YFT caught	543.9	36923.4	16.7	703.9	47783.7	21.7	182.4	12382.6	5.6
Dolphin caught	139.7	2276.0	1.0	2934.9	47806.7	21.7	250.8	4085.3	1.9
Shortfin mako	10.2	627.0	0.3	31.8	1953.6	0.9	36.5	2247.8	1.0
Blue shark	0.0	0.0	0.0	71.3	4384.6	2.0	61.0	3751	1.7
BUM	22.7	-	-	18.2	-	-	2.3	-	-
SAI	25.9	-	-	14.6	-	-	0.0	-	-
WHM	43.3	-	-	5.5	-	-	28.3	-	-
TLB	10.2	-	-	13.8	-	-	2.4	-	-
TTL	2.9	-	-	4.8	-	-	4.3	-	-

Table 4.3 Projected Catch Estimates by Area for all Compensated Research Sets Conducted Under The Auspices Of A Federal Exempted Fishing Permit. Source: Weight/Numbers of Fish Data from Pelagic Observer Program data 2001-2003. Percent change data from results of NED experiment NOAA Fisheries 2004d.

Species	Gulf of Mexico			South of Cape Hatteras			North of Cape Hatteras		
	Observed Catch (Metric Tons)	**Projected Catch** (% Change with 16/0)	**Projected Catch** (% Change with 18/0)	**Observed Catch (Metric Tons)**	**Projected Catch** (% Change with 16/0)	**Projected Catch** (% Change with 18/0)	**Observed Catch (Metric Tons)**	**Projected Catch** (% Change with 16/0)	**Projected Catch** (% Change with 18/0)
SWO	15.8	12.6 to 14.2 (-10% to -20%)	10.7 to 20.6 (-32.58% to 30.24%)	20.3	16.2 to 18.3 (-10% to -20%)	13.7 to 26.4 (-32.58% to 30.24%)	4.2	3.4 to 3.8 (-10% to -20%)	2.8 to 3 (-32.58% to 30.24%)
BFT	3.1	-	0.4 to 4 (-87% to 29%)	14.9	-	1.9 to 19.2 (-87% to 29%)	5.1	-	0.7 to 6.6 (-87% to 29%)
	Observed Catch (# of Fish)	**Projected Catch** (% Change with 16/0)	**Projected Catch** (% Change with 18/0)	**Observed Catch (# of Fish)**	**Projected Catch** (% Change with 16/0)	**Projected Catch** (% Change with 18/0)	**Observed Catch (# of Fish)**	**Projected Catch** (% Change with 16/0)	**Projected Catch** (% Change with 18/0)
TLB	10.2	5.1 (-50%)	3.7 (-64%)	13.8	6.9 (-50%)	5 (-64%)	2.4	2.1 (-50%)	0.9 (-64%)
TTL	2.9	2.9 (0%)	0.4 to 4.8 (-85% to 64%)	4.8	4.8 (0%)	0.7 to 7.9 (-85% to 64%)	4.3	4.3 (0%)	0.6 to 7.1 (-85% to 64%)

Table 4.4 Comparison of Final Alternatives. This table compares the impacts of the alternatives considered in this Chapter. The symbols +, -, 0 refer to positive, negative, and zero impacts respectively. Minor impacts and impacts that are possible but unlikely are noted with + or -. More than minor impacts are noted with ++ or --, and significant impacts are noted with +++ or ---.

Exempted Fishing Permit Alternative	Ecological Impacts	Economic Impacts	Social Impacts
1: Deny EFPs (No Action/Status Quo)	0	0	0
2: Authorize GOM EFP, as requested	-	0	+
3: Authorize GOM EFP, as modified	+	0	+
4: Authorize FEC/SAB EFP	+	0	+
5: Authorize MAB/NEC EFP	+	0	+

5.0 MITIGATION AND UNAVOIDABLE ADVERSE IMPACTS

5.1 Mitigating Measures

NMFS does not expect the preferred alternatives outlined herein to have significant ecological, economic, or social impacts. Additional terms and conditions (i.e., 100% observer coverage, hail in/out requirements, and additional reporting requirements) will be added to the exempted fishing permits in order to monitor and thus mitigate further any minor impacts associated with this action.

5.2 Unavoidable Adverse Impacts

The alternatives outlined herein are not expected to have any unavoidable adverse impacts.

5.3 Irreversible and Irretrievable Commitment of Resources

The alternatives outlined herein are not expected to result in any irreversible or irretrievable commitments of resources.

6.0 ECONOMIC EVALUATION

This section assesses the economic impacts of the alternatives presented in this document. Since the EFP research activities impact the HMS pelagic longline sector, NMFS analyzed the number of pelagic longline vessels, the catch and revenues associated with this sector, the costs of longline fishing, and the specific impacts associated with the various alternatives considered for these EFP requests. Additional economic and social considerations and information are discussed in the annual SAFE report.

6.1 Number of Permit Holders

The 1999 Tunas, Swordfish, and Shark FMP established six different limited access permit types: 1) directed swordfish, 2) incidental swordfish, 3) swordfish handgear, 4) directed shark, 5) incidental shark, and 6) tuna longline. To reduce bycatch concerns in the pelagic longline fishery, these permits were designed so that the swordfish directed and incidental permits are valid only if the permit holder also holds both a tuna longline and a shark permit. Similarly, the tuna longline permit is valid only if the permit holder also holds both a swordfish (directed or incidental, not handgear) and a shark permit. Swordfish handgear and shark permits are valid without another limited access permit.

As of October 2004, approximately 208 tuna longline limited access permits had been issued. In addition, approximately 195 directed swordfish limited access permits, 99 incidental swordfish limited access permits, 241 directed shark limited access permits, and 348 incidental shark limited access permits had been issued. Vessels with limited access swordfish and shark permits do not necessarily use pelagic longline gear, but these are the only permits that allow for the use of pelagic longline gear. Because pelagic longline vessels must possess a tuna longline permit, a swordfish permit (directed or incidental), and a shark permit (directed or incidental) to be considered valid, the maximum number of vessels potentially fishing for HMS using pelagic longline gear is 294 (*e.g.* the number of limited access swordfish permits issued).

Not all valid and permitted HMS longline vessels actually report fishing with pelagic longline gear in the logbooks (considered "active"). In 2003, 127 vessels reported pelagic longline activity in the pelagic logbook. Table 6.1 lists the number of active pelagic longline vessels from 1990 to 2003. The number of active vessels has been decreasing since 1994.

6.2 Gross Revenue of Fishermen

Gross revenues of pelagic longline vessels vary greatly depending upon fishing location, target species, species availability, and unique characteristics of a vessel's fishing trips. In recent years, several analyses have been conducted to examine average annual gross revenues of pelagic longline vessels targeting HMS (Porter *et al.*, 2001; NMFS, 2000; and, NOAA Fisheries, 2002). These studies indicate average annual vessel gross revenues ranging from $113,173.00 (NMFS, 2000) to $250,000.00 (Porter *et al.*, 2001). These studies confirm that annual and trip-specific gross revenues are highly variable among vessels, probably due to the diversity of the pelagic longline fleet. Other factors contributing to the wide variability of average gross revenue estimates include changes in the number of permitted vessels and changes in ex-vessel prices. In general, swordfish, yellowfin tuna, and bigeye tuna contributed the most revenue, among HMS species, to pelagic longline vessels. One study also found that sandbar sharks are an important source of revenue (Larkin *et al*., 2000).

Using the number of fish landed as reported in 2003 pelagic longline logbooks (Table 6.2) and the average weight per fish (Table 6.3), NMFS calculated 2003 landings, by weight (Table 6.4). Then, using 2003 ex-vessel prices for Atlantic HMS caught using pelagic longline gear (Table 6.5), NMFS calculated the annual overall gross revenue of the pelagic longline fleet. The annual gross revenue estimate was then divided by the 127 active vessels reporting landings to derive an average annual gross revenue per vessel. These calculations indicate that an overall 2003 annual gross revenue estimate for the pelagic longline fleet of approximately $24.7 million dollars (Table 6.6). The average pelagic longline vessel is estimated to have produced an annual gross revenue of approximately $194,000 in 2003. This value is a fleet-wide estimate for all Atlantic HMS pelagic longline vessels reporting landings.

Most HMS revenues were derived from landings of swordfish ($11.4 million), yellowfin tuna ($10.0 million), and bigeye tuna ($1.5 million). Five statistical regions accounted for over 85 percent of HMS landings revenue: the Gulf of Mexico (44.7 percent), the Mid-Atlantic Bight (12.9 percent), the South Atlantic Bight (11.5), the Northeast Distant area (10.5), and the Northeast Coastal area (7.7 percent).

6.3 Variable Costs and Net Revenues of Pelagic Longline Fishing

In 2003, NMFS initiated mandatory cost earnings reporting for selected vessels to improve the economic data available for all HMS fisheries. Currently, however, there are little additional data or new reports regarding fishing costs and revenues. Most of the studies regarding pelagic longline variable costs and net revenues available to NMFS analyze data from 1996 and 1997, which remain the best available estimates on the potential costs of pelagic longline fishing. Where noted, NMFS has converted 1996 and 1997 dollars to 2002 dollars using the consumer price index on-line inflation calculator provided by the Bureau of Labor Statistics (http://www.bls.gov/cpi/home.htm).

Larkin *et al.* (2000) examined 1996 logbooks and the 1996 voluntary economic forms and found that net returns to a vessel owner varied substantially depending on the vessel size and the fishing behavior (*i.e.* sets per trip, fishing location, season, target species). They found that out of 3,255 pelagic longline trips reported in 1996, 642 pelagic longline trips provided the voluntary economic information. Larkin *et al*. (2000) suggest using median values (half of the fleet is less than this value and half is above) instead of mean values (the average of all vessels) given the high degree of skewness to the data. For example, the mean owner’s share of a trip is $4,412 while the median is $2,242. Larkin *et al*. (2000) suggest that the median values identify the characteristics of the majority of the fleet better than the mean, which can be influenced by outliers (a few vessels that may not be similar to the rest of the fleet). The mean supply costs per trip for the vessels sampled was $5,959 and median was $3,666 (Table 6.7). This changed depending on area fished with the median ranging from $1,928 in the area between North Carolina and the east coast of Florida (FEC to MAB) and $10,100 in the Caribbean. Vessels in the NED area (Maine to Virginia region in Larkin *et al*. (2000)) had a median supply cost per trip of $2,831 or $3,246 in 2002 dollars. For the entire fleet, Larkin *et al*. (2000) found that the average net revenues per vessel per trip was $7,354 ($8,432 in 2002 dollars). Vessels fishing in the Caribbean and Maine to Virginia areas had the largest average net returns to the vessel owner per trip at $12,188 and $6,672, respectively ($13,975 and $7,650, respectively, in 2002 dollars). Generally, Larkin *et al*. (2000) found that vessels that were between 46 and 64 feet in length, had between 10 and 21 sets per trip, fished in the second quarter, fished in the Caribbean, or had more than 75 percent of their gross revenues from swordfish had the highest net return to the owner (ranging from $3,187 to $13,097 per trip) while vessels that were less than 45 feet in length, had between one and three sets per trip, fished in the first quarter, fished between North Carolina and Miami, FL, or had between 25 and 50 percent of their gross revenues from swordfish had the lowest net return to the owner (ranging from $642 to $1,885 per trip).

Porter *et al*. (2001) conducted a survey of 147 vessels along the Atlantic and Gulf of Mexico (110 surveys were completed) in 1998 regarding 1997 operations. Survey information was combined with trip tickets and logbook data. They found that on average, vessels received approximately $250,000 annual gross revenues, annual variable costs were approximately $190,000, and annual fixed costs were approximately $50,000. Thus, vessels were left with approximately $8,000 to cover depreciation on the vessel and the vessel owner lost approximately $3,500 per year. On a per trip level, gross revenues averaged $22,000 and trip expenses, including labor, were $16,000. Labor cost the owner the most (43 percent), followed by gear. Generally trip returns were divided so the vessel owner received 43 percent and the captain and crew 57%. Porter *et al*. (2001) noted that 1997 was probably a financially poor year due to a reduction in swordfish quota and a subsequent closure of the fishery (this fishery has not been closed since). Similar to Larkin *et al*. (2000), Porter *et al*. (2001) noted differences between region, vessel size, and target species. While all vessels had an average net return per trip of $5,556 ($6,228 in 2002 dollars), vessels that fished in the New England or Caribbean regions had much higher net returns per trip at $20,772 and $18,940, respectively ($23,283 and $21,229, respectively in 2002 dollars) (Table 6.8).

In general, both Larkin *et al*. (2000) and Porter *et al*. (2001) found that the average net return to a vessel is fairly low after all variable costs including labor were accounted for. This was true even of vessels fishing in the northeast region or Caribbean (i.e., regions with relatively high gross revenues). This corresponds with the results of Ward and Hanson (1999) who found that fifty percent of the fleet earns $10,000 or less annually and that each year 20 percent of the fleet actually has a loss. Additionally, as suggested by Larkin *et al*. (2000) in their discussion of mean versus median values, Ward and Hanson (1999) found there were a number of vessels that earned much higher net revenues than the average vessel with 19 percent of the fleet earning $50,000 or more annually and 7 percent earning more than $100,000 annually.

6.4 Expected Economic Impacts of Alternatives Considered

Section 2.2 details the alternatives considered. In this section, the economic impacts of each of these alternatives are analyzed.

6.4.1 Economic Analysis of Alternative 1

Alternative 1 considers maintaining the status quo by denying the EFP applications and maintaining existing regulations, which prohibit pelagic longline fishing in closed regions. This alternative would result in no change to the existing economic baseline conditions. However, this alternative foregoes the possibility to increase information regarding the potential to reduce bycatch though gear modifications. Improved information regarding bycatch reduction in closed areas is economically valuable in that it could lead to changes regarding the restrictions currently required for closed areas. Improved information leading to more flexible regulation of the closed areas could allow for greater flexibility in fishing effort and thus potentially increasing net revenues by decreasing operating costs and/or increasing catch per unit effort.

6.4.2 Economic Analysis of Alternative 2

Alternative 2 considers authorizing the EFP for the Gulf of Mexico (GOM) research segment. This EFP would allow the use of experimental pelagic longline fishing gear in the DeSoto Canyon closed area for research. Vessels conducting research in the DeSoto Canyon closed area would be allowed to retain undersized swordfish which cannot be returned to the sea alive for controlled donation to an NMFS-approved food bank as well as be allowed to offset economic impacts by selling legal sized swordfish caught during exempted fishing operations. The EFP would also allow the retention of legal size swordfish for sale by vessels with incidental swordfish permits participating in the study. The researchers would compensate the two vessels for a fixed dollar amount per set for a maximum of 50 sets each for the research inside the DeSoto Canyon Closed Area. In addition, the participating vessels would earn revenue though the sale of legal sized fish obtained during the research sets. In order to analyze the economic impacts of this EFP, as well as the other EFPs analyzed in this document, an estimate of the average catch retained per set is necessary.

Table 6.9 lists the average number of each species retained in 2003 per set by statistical area as reported in Pelagic Longline Logbooks. Then using the average weight per fish provided in Table 6.3, NMFS calculated the average dress weight of the catch retained in each set. Using the average prices for fish caught using pelagic longline gear reported in Table 6.5, the average revenue per set is estimated in Table 6.11.

These historical numbers are likely to vary from the conditions in the experimental design for the EFP, since they do not reflect the bycatch reduction modifications being utilized by the vessels. In particular, all sets will be using circle hooks exclusively in this research study. The historical data primarily reflects the use of J-style hooks. In addition, the vessels selected are likely to be above average performers, and thus might catch fish more efficiently than the rest of the fleet.

As indicated in Table 6.11, the estimated average gross revenue per set in the Gulf of Mexico statistical region is $2,203. Each research vessel under the GOM EFP will conduct 50 sets that will produce a catch worth approximately $110,150 per vessel during the experiment. The total value of the fish harvested in this experiment in the GOM would be worth approximately $220,300.

In addition, the two vessels cooperating in this research effort will also receive a fixed compensation per set by the researchers for their efforts. The vessels will also be contributing undersized swordfish to a food-bank, and thus provide an economic benefit to those in need. These economic benefits are short-term benefits that will occur within a year.

There are potential long-term benefits of this research. The research derived from this project could provide information that might lead to more efficient management of the HMS fisheries in the GOM closed area. This may lead to long-term increases in the efficiency and operating margins of the vessels operating in the vicinity of the closed area.

There are no long-term economic costs that are apparent from approving the limited activities described in the GOM EFP. There, however, could be short term economic impacts from permitting fishing in the DeSoto Canyon closed area and allowing the sale of legal sized swordfish by the one participating vessel with an incidental swordfish permit. The potential distributional economic impact from allowing these two vessels to fish in the closed area might allow them to have a competitive advantage to other vessels not allowed in the area. However, due to the restrictive nature of the experimental design, it is not likely that these two vessels will receive any true economic advantage. Legal sized fish that are retained and sold by the research vessels operating in the closed area will count towards species quotas and will impact the quota available to vessels operating outside of the closed area during this one year. The additional swordfish sales will not result in a major economic impact since current landings have been significantly below the quota limit, as reported in Table 4.1.

Allowing the vessel with an incidental swordfish permit to retain legal sized swordfish beyond the two swordfish per trip limit could have a short term impact on the directed swordfish fleet by reducing their available quota by the amount of swordfish retained by the research vessel with the incidental swordfish permit. This impact is anticipated to be minimal considering that this vessel will direct on yellowfin tuna, where few incidental captures of swordfish are expected to occur.

6.4.3 Economic Analysis of Alternative 3

Alternative 3 considers authorizing exempted fishing permits to conduct scientific research in the closed regions of the Gulf of Mexico (GOM) statistical areas of the Atlantic Ocean, as modified by NMFS to include a no sale provision beyond the existing commercial retention limits (i.e., 2 swordfish) for incidental permit holders conducting research in the DeSoto Canyon closed area.

The economic impact of this alternative varies from Alternative 2 by the amount of swordfish that can be sold. Based on 2003 Pelagic Longline Logbook data, it is estimated that 1.9 swordfish are retained per set in the GOM. However, under Alternative 3 only 2 swordfish can be retained and sold per trip for incidental swordfish permit holders. Using the Pelagic Longline Logbook data set for 2003, it was estimated that on average pelagic longline vessels conduct 6 sets per trip. Therefore, 50 sets on average would be conducted in slightly more than eight trips. Eight trips would allow an incidental swordfish permit holder to retain 16 swordfish. Those 16 swordfish, using the figures in Table 6.3 and Table 6.5, are estimated to have an ex-vessel value of $3,341. Not allowing the retention and sale of swordfish in excess of incidental swordfish permit limit, the estimated revenue from 50 sets is estimated to be $93,641, or $16,509 less than under Alternative 2. The total value of the fish harvested under Alternative 3 for all 100 sets would be worth approximately $203,791.

The economic impacts of Alternative 3 are very similar to the economic impacts of Alternative 2 with one exception. Alternative 3 would not allow incidental swordfish permit holders participating in the EFP research to retain legal sized swordfish in excess of the permit limit of 2 swordfish per trip. Therefore, there would be minimal reduction of the swordfish quota available to the directed swordfish limited access permit holders by the activities of the incidental permit holder participating in this research.

6.4.4 Economic Analysis of Alternative 4

Alternative 4 considers authorizing exempted fishing permits to conduct scientific research in the closed regions of the Florida East Coast (FEC) and South Atlantic Bight (SAB) statistical areas of the Atlantic Ocean. This alternative would permit two domestic pelagic longline vessels to conduct 50 compensated bycatch reduction fishing sets within the South of Cape Hatteras region to be determined by historical data as the highest interaction timeframe for the regional bycatch priority species. For the analysis of this alternative, we will assume that half of the sets will occur in the FEC and half in the SAB.

In order to analyze the economic impacts of this EFP, an estimate of the average catch retained per set is necessary. As indicated in Table 6.11, the estimated average gross revenue per set in the Florida East Coast statistical region is $1,737 and in the South Atlantic Bight it is $3,321. The total value of the revenues generated from the 50 sets covered by Alternative 4 is estimated to be $126,450.

In addition, the two vessels cooperating in this research effort will also receive a fixed compensation per set by the researchers for their efforts. The vessels will also be contributing undersized swordfish to a food-bank, and thus provide an economic benefit to those in need. These economic benefits are short-term benefits that will occur within one year.

There are potential long-term benefits of this research. The research derived from this project could provide information that might lead to more efficient management of the HMS fisheries in the East Coast of Florida closed area. This may lead to long-term increases in the efficiency and operating margins of the vessels operating in the vicinity of the closed area.

There are no long-term economic costs that are apparent from approving the limited activities described in Alternative 4. There, however, could be short-term economic impacts from the permitting of fishing in the East Coast of Florida closed area. The potential distributional economic impact from allowing these two vessels to fish in the closed area might allow them to have a competitive advantage to other vessels not allowed in the area. However, due to the restrictive nature of the experimental design, it is not likely that these two vessels will receive any true economic advantage. Fish that are retained and sold by the research vessels operating in the closed area will count towards species quotas and will impact the quota available to vessels operating outside of the closed area.

6.4.5 Economic Analysis of Alternative 5

Alternative 5 considers authorizing exempted fishing permits to conduct scientific research in the closed regions of the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) statistical areas of the Atlantic Ocean. This alternative would permit two domestic pelagic longline vessels to conduct 50 compensated bycatch reduction fishing sets within the North of Cape Hatteras region to be determined by historical data as the highest interaction timeframe for the regional bycatch priority species. For the analysis of this alternative, we will assume that half of the sets will occur in the MAB and half in the NEC.

In order to analyze the economic impacts of this EFP an estimate of the average catch retained per set is necessary. As indicated in Table 6.11, the estimated average gross revenue per set in the Mid-Atlantic Bight statistical region is $3,367 and in the Northeast Coastal it is $3,438. The total value of the revenues generated from the 50 sets covered by Alternative 5 is estimated to be $170,125.

In addition, the two vessels cooperating in this research effort will also receive a fixed compensation per set by the researchers for their efforts. The vessels will also be contributing undersized swordfish to a food-bank, and thus provide an economic benefit to those in need. These economic benefits are short-term benefits that will occur within one year.

There are potential long-term benefits of this research. The research derived from this project could provide information that might lead to more efficient management of the HMS fisheries in the closed area. This may lead to long-term increases in the efficiency and operating margins of the vessels operating in the vicinity of the closed area.

There are no long-term economic costs that are apparent from approving the limited activities described in Alternative 5. There, however, could be short-term economic impacts from the permitting of fishing in the closed area. The potential distributional economic impact from allowing these two vessels to fish in the closed area might allow them to have a competitive advantage to other vessels not allowed in the area. However, due to the restrictive nature of the experimental design, it is not likely that these two vessels will receive any true economic advantage. Fish that are retained and sold by the research vessels operating in the closed area will count towards species quotas and will impact the quota available to vessels operating outside of the closed area.

6.4.6 Economic Analysis of the Preferred Alternative

NMFS does not anticipate that any of the preferred alternatives either individually or cumulatively will result in significant economic impacts.

Table 6.1 The number of Vessels that Reported Fishing with Pelagic Longline Gear in the Pelagic Logbook. Source: Pelagic Logbook data.

Year	Number of active vessels	Year	Number of active vessels
1990	416	1997	350
1991	333	1998	268
1992	337	1999	224
1993	434	2000	199
1994	501	2001	161
1995	489	2002	148
1996	367	2003	127

Table 6.2 2003 PLL Landings (number of fish) by Statistical Region. Source: Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center. CAR: Caribbean, GOM: Gulf of Mexico, FEC: Florida east coast, SAB: South Atlantic Bight, MAB: Mid-Atlantic Bight, NEC: Northeast Coastal, NED: Northeast Distant, SAR: Sargasso, NCA: North Central Atlantic, SAT: tuna north and tuna south.

Area	Swordfish	Bluefin tuna	Yellowfin tuna	Bigeye tuna	Other tuna	Pelagic sharks	Large coastal sharks
CAR	2,799	0	97	167	37	4	2
GOM	9,563	138	38,263	436	158	139	35
FEC	4,024	6	1,548	2,369	1,293	59	69
SAB	12,402	8	717	36	49	292	2,459
MAB	5,683	45	6,652	1,775	2,029	1,734	2,710
NEC	5,069	22	2,698	572	650	401	51
NED	9,128	42	177	915	99	370	0
SAR	1,156	11	19	279	495	7	0
NCA	1,612	1	2	38	136	16	0
SAT	399	0	644	886	85	15	0
Total	**51,835**	**273**	**50,817**	**7,473**	**5,031**	**3,037**	**5,326**

Table 6.3 The 1998 Average Ex-vessel Weight (lb dw) Used to Estimate 2003 Landings by Weight. Data reported to the Southeast Fisheries Science Center.

Species	Ave Weight (lb dw)
Swordfish	71.77
Bluefin Tuna	606.69
Yellowfin Tuna	60.29
Bigeye Tuna	67.64
Other Tunas	31.06
Large Coastal Sharks	40.36
Other Sharks	90.82
Other Fish	24.58

Table 6.4 2003 PLL Landings (lbs dw) by Statistical Region. Source: Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center. CAR: Caribbean, GOM: Gulf of Mexico, FEC: Florida east coast, SAB: South Atlantic Bight, MAB: Mid-Atlantic Bight, NEC: Northeast Coastal, NED: Northeast Distant, SAR: Sargasso, NCA: North Central Atlantic, SAT: tuna north and tuna south.

Area	Swordfish	Bluefin tuna	Yellowfin tuna	Bigeye tuna	Other tuna	Pelagic sharks	Large coastal sharks
CAR	200,884	0	5,848	11,296	1,149	363	81
GOM	686,337	83,723	2,306,876	29,491	4,907	12,624	1,413
FEC	288,802	3,640	93,329	160,239	40,161	5,358	2,785
SAB	890,092	4,854	43,228	2,435	1,522	26,519	99,245
MAB	407,869	27,301	401,049	120,061	63,021	157,482	109,376
NEC	363,802	13,347	162,662	38,690	20,189	36,419	2,058
NED	655,117	25,481	10,671	61,891	3,075	33,603	0
SAR	82,966	6,674	1,146	18,872	15,375	636	0
NCA	115,693	607	121	2,570	4,224	1,453	0
SAT	28,636	0	38,827	59,929	2,640	1,362	0
Total	**3,720,198**	**165,626**	**3,063,757**	**505,474**	**156,263**	**275,820**	**214,957**

Table 6.5 Average ex-vessel prices per lb. dw for Atlantic HMS caught using PLL gear by area. Source: Dealer weigh out slips from the Southeast Fisheries Science Center and Northeast Fisheries Science Center, and bluefin tuna dealer reports from the Northeast Regional Office. HND=Handline, harpoon, spears, trot lines, and trolls, PLL=Pelagic longline, BLL=Bottom longline, Net=Gillnets and pound nets, TWL=Trawls, SEN=Seines, TRP=Pots and traps, DRG=Dredge, and UNK=Unknown. Gulf of Mexico includes: TX, LA, MS, AL, and the west coast of FL. S. Atlantic includes: east coast of FL. GA, SC, and NC dealers reporting to Southeast Fisheries Science Center. Mid-Atlantic includes: NC dealers reporting to Northeast Fisheries Science Center, VA, MD, DE, NJ, NY, and CT. N. Atlantic includes: RI, MA, NH, and ME. For bluefin tuna, all NC landings are included in the Mid-Atlantic.

Species	Average for Gulf of Mexico only	Average for S. Atlantic region only	Average for Mid-Atlantic region only	Average for N. Atlantic region only
Bigeye tuna	$3.41	$2.26	$3.92	$3.50
Bluefin tuna	$6.32	$4.11	$6.25	$4.21
Yellowfin tuna	$3.64	$2.09	$2.00	$2.57
Other tuna	$0.66	$1.26	$0.93	$1.00
Swordfish	$2.91	$2.98	$2.97	$3.36
Large coastal sharks	$0.38	$0.35	$2.32	$0.28
Pelagic sharks	$1.11	$0.93	$1.32	$1.30
Small coastal sharks	$0.33	$0.24	$0.39	-
Shark fins	$15.21	$12.72	-	-

Table 6.6 2003 Gross Revenues ($) by Statistical Region. Source: Landings to derive dollar values are from the Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center. CAR: Caribbean, GOM: Gulf of Mexico, FEC: Florida east coast, SAB: South Atlantic Bight, MAB: Mid-Atlantic Bight, NEC: Northeast Coastal, NED: Northeast Distant, SAR: Sargasso, NCA: North Central Atlantic, SAT: tuna north and tuna south.

Area	Swordfish	Bluefin tuna	Yellowfin tuna	Bigeye tuna	Other tuna	Pelagic sharks	Large coastal sharks	Total
CAR	$598,635	$0	$12,223	$25,529	$1,448	$338	$28	$638,200
GOM	$1,997,239	$529,131	$8,397,030	$100,564	$3,239	$14,013	$537	$11,041,752
FEC	$860,631	$14,961	$195,057	$362,141	$50,602	$4,983	$975	$1,489,351
SAB	$2,652,473	$19,948	$90,346	$5,503	$1,918	$24,663	$34,736	$2,829,587
MAB	$1,211,371	$170,632	$802,098	$470,639	$58,609	$207,876	$253,751	$3,174,976
NEC	$1,222,375	$56,192	$418,042	$135,415	$20,189	$47,344	$576	$1,900,134
NED	$2,201,192	$107,275	$27,425	$216,617	$3,075	$43,684	$0	$2,599,268
SAR	$247,239	$27,428	$2,394	$42,650	$19,372	$591	$0	$339,675
NCA	$344,766	$2,493	$252	$5,809	$5,322	$1,351	$0	$359,994
SAT	$85,336	$0	$81,148	$135,440	$3,327	$1,267	$0	$306,517
Total	**$11,421,257**	**$928,060**	**$10,026,016**	**$1,500,307**	**$167,101**	**$346,111**	**$290,603**	**$24,679,455**

Table 6.7 **The Cost-earnings Characteristics of 1996 Pelagic Longline Trips.** Source: Larkin et al. 2000.Note: Numbers in the table are in 1996 dollars and denote the median not the mean, unless otherwise noted.

Variable	All trips	Region			
		ME to VA	NC to FL	TX to FL	Caribbean
Number of trips	642	86	189	319	47
Number of crew	4	3	2	4	4
Total Gross Revenues	$8,916	$7,060	$4,826	$9,387	$26,227
Fuel costs	$1,031	$753	$410	$1,266	$1,970
Bait costs	$960	$965	$590	$1,000	$2,705
Ice costs	$256	$185	$150	$330	$300
Light sticks	$360	$94	$198	$597	$1,295
Miscellaneous costs	$305	$171	$42	$821	$1,560
Total costs	$3,666	$2,831	$1,928	$5,230	$10,100
Net return to owner	$2,242	$2,671	$1,740	$2,022	$8,020
Mean net return to owner	$4,412	$6,672	$3,679	$3,099	$12,188

Table 6.8 Cost-earnings Characteristics of an Average 1997 Pelagic Longline Trip. Source: Porter *et al.*, 2001. Note: Numbers in the table are in 1997 dollars and denote the mean.

Variable	All vessels	Region				
		New England	Mid-Atlantic	South Atlantic	Gulf of Mexico	Caribbean
Length of trip	13	36	12	8	14	28
Gross revenues	$22,364	$81,569	$20,151	$11,242	$16,437	$67,440
Fuel costs	$2,071	$9,209	$2,154	$717	$1,703	$5,601
Ice costs	$297	$378	$252	$191	$469	$372
Bait costs	$1,559	$4,779	$1,488	$882	$1,406	$3,771
Light sticks	$738	$3,129	$635	$392	$490	$2,164
Food costs	$897	$2,943	$817	$438	$881	$2,270
Gear costs	$2,336	$6,800	$2,147	$1,381	$2,067	$5,808
Other costs	$442	$1,687	$414	$206	$342	$1,293
Total variable costs (not labor)	$9,634	$34,725	$8,839	$5,007	$7,867	$25,880
Total labor costs	$7,173	$26,071	$6,558	$3,670	$4,727	$22,620
Net return	$5,556	$20,772	$4,753	$2,565	$3,843	$18,940

Table 6.9 Average number of each species retained per set by area in 2003. Source: Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center.

Area	Swordfish	Bigeye Tuna	Yellowfin Tuna	Bluefin Tuna	Other Tuna	Large Coastal Sharks	Pelagic Sharks	NonHMS
NEC	9.2	1.0	4.9	0.04	1.2	0.09	0.7	3.8
MAB	6.0	1.9	7.0	0.05	2.2	2.9	1.8	2.2
SAB	14.6	0.04	0.8	0.009	0.07	2.9	0.3	18.4
FEC	4.7	2.7	1.8	0.007	1.6	0.08	0.07	2.7
GOM	1.9	0.08	7.6	0.03	0.08	0.007	0.03	3.0

Table 6.10 **Average weight (lb dw) of retained fish per set by species and area in 2003.** Source: Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center.

Area	Swordfish	Bigeye Tuna	Yellowfin Tuna	Bluefin Tuna	Other Tuna	Large Coastal Sharks	Pelagic Sharks	NonHMS
NEC	660	68	295	24	37	4	64	93
MAB	431	129	422	30	68	117	163	54
SAB	1048	3	48	5	2	117	27	452
FEC	337	183	109	4	50	3	6	66
GOM	136	5	458	18	2	0	3	74

Table 6.11 **2003 Average Gross Revenue per Set by Statistical Region.** Source: Landings to derive dollar values are from the Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center. Prices come from dealer weigh out slips from the Southeast Fisheries Science Center and Northeast Fisheries Science Center, and bluefin tuna dealer reports from the Northeast Regional Office.

Area	Swordfish	Bigeye Tuna	Yellowfin Tuna	Bluefin Tuna	Other Tuna	Large Coastal Sharks	Pelagic Sharks	Total
NEC	$2,219	$237	$759	$102	$37	$1	$83	**$3,438**
MAB	$1,279	$504	$844	$190	$64	$272	$216	**$3,367**
SAB	$3,123	$6	$101	$22	$3	$41	$25	**$3,321**
FEC	$1,005	$413	$227	$17	$63	$6	$6	**$1,737**
GOM	$397	$18	$1,668	$115	$2	$0	$3	**$2,203**

7.0 COMMUNITY PROFILES

Mandates to conduct social impact assessments come from both the National Environmental Policy Act (NEPA) and the Magnuson-Stevens Act. NEPA requires federal agencies to consider the interactions of natural and human environments by using a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making [NEPA section 102(2)(a)]. Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects, which may be direct, indirect, or cumulative. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the consequences of these actions need to be examined in order to mitigate the negative impacts experienced by the populations concerned.

Social impacts are generally the consequences to human populations that follow from some type of public or private action. They may include alterations to the ways people live, work or play, relate to one another, and organize to meet their needs. In addition, cultural impacts, which may involve changes in values and beliefs that affect people's way of identifying themselves within their occupation, communities, and society in general, are included under this interpretation. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Although public hearings and scoping meetings provide input from those concerned with a particular action, they do not constitute a full overview of the affected constituents.

As mentioned in previous sections, NMFS does not anticipate that any of these alternatives either individually or cumulatively will result in significant social impacts. None of the alternatives drastically modify the HMS fisheries, as they currently exist.

For additional information pertaining to community profiles see NOAA Fisheries 2004d.

8.0 OTHER CONSIDERATIONS

8.1 National Standards

The analyses in this document are consistent with the National Standards (NS) set forth in the 50 C.F.R. part 600 regulations.

This action would be consistent with NS 1 in that the proposed exempted fishing activities are part of a scientific research plan to reduce bycatch and bycatch mortality of HMS; thus facilitating efforts to prevent overfishing of HMS in the Atlantic Ocean. Additionally, the fish caught as a result of this exempted fishing activity would be counted against the appropriate quotas, which are consistent with rebuilding plans for those species. The alternatives considered are based on the best scientific information available (NS 2), including stock assessment, observer, and logbook data, which provide for the management of the species throughout their ranges (NS 3). The alternatives considered do not discriminate against fishermen in any state (NS 4) nor do they alter the efficiency in utilizing the resource (NS 5). With regard to NS 6, the alternatives take into account any variations that may occur in the fishery and the fishery resources by analyzing the possibility for shifts in fishing effort. Additionally, NMFS considered the costs and benefits of the various alternatives both economically and socially under NS 7 and 8 in Chapters 4, 6, and 7 of this document. The alternatives considered would investigate gear modifications and/or various fishing techniques that avoid/reduce bycatch and bycatch mortality of juvenile HMS (NS 9). Finally, the alternatives considered would not require fishermen to fish in an unsafe manner (NS 10).

8.2 Paperwork Reduction Act

This action does not contain any new collection-of-information requirement for purposes of the Paperwork Reduction Act approved by OMB under 0648-0471.

8.3 Federalism

This action does not contain regulatory provisions with federalism implications sufficient to warrant preparation of a Federalism Assessment under E.O. 13132.

9.0 LIST OF PREPARERS

This document was prepared by a team of individuals currently employed by the Office of Sustainable Fisheries of the National Marine Fisheries Service including:

Karyl Brewster-Geisz, M.S., Fishery Management Specialist
Christopher Rogers, Ph.D., Division Chief
George Silva, MA, Economist
Heather Stirratt, MAMA, Fishery Management Specialist
Jackie Wilson, Ph.D., SeaGrant Fellow

Individuals in other offices within NMFS contributed including the Office of Protected Resources and the Office of General Counsel.

10.0 LIST OF AGENCIES AND PERSONS CONSULTED

Discussions pertinent to formulation of the proposed exempted fishing activities involved input from a variety of scientific and constituent interest groups including the commercial, recreational fishermen, environmental advocates, and staff from the NMFS and the NOAA General Counsel for Fisheries.

11.0 REFERENCES

Appeldoorn, R. and S. Meyers. 1993. Puerto Rico and Hispañola, pp. 99-158, *in:* Marine fishery resources of the Antilles: Lesser Antilles, Puerto Rico and Hispañiola, Jamaica, Cuba. Food and Agriculture Organization (FAO), Fisheries Technical Paper. No. 326. Rome, FAO, 235 pp.

Arocha, F. 1997. The reproductive dynamics of swordfish *Xiphias gladius* L. and management implications in the northwestern Atlantic. University of Miami, PhD. Dissertation. Coral Gables, FL. 383 pp.

Bester, C. and G. Burgess. 2004. Biological Profiles – Finetooth Shark. Florida Museum of Natural History – Ichthyology Division. January 11, 2005. http://www.flmnh.ufl.edu/fish/Gallery/Descript/finetoothshark/finetoothshark.html

Burgess, G.H. and A. Morgan. 2004. Commercial shark fishery observer program; an observer program report on the monitoring of the directed commercial shark fishery in the eastern Gulf of Mexico and South Atlantic 2003(2) fishing season. Final report to Highly Migratory Species Division, National Marine Fisheries Service. Award No. NA03NMF4540075.

Carlson, J.K. 2000. Progress report on the directed shark gillnet fishery: right whale season, 2002. NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL. Sustainable Fisheries Division Contribution SFD-99/00-90. 12 pp.

Carlson, J. K. and D. Lee. 1999. The Directed Shark Drift Gillnet Fishery:Catch and Bycatch 1998-1999. NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL. Sustainable Fisheries Division Contribution No. SFD-99/00-87. 11 pp.

Carlson, J. and I. Baremore. 2001. The directed shark gillnet fishery: non-right whale season, 2000 and 2001. SFD Contribution PCB-01/02-002. Panama City, FL. 8pp.

Carlson, J. K. and I. Baremore. 2002a. The directed shark gillnet fishery: non-right whale season, 2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL. Sustainable Fisheries Division Contribution PCB-02/12. 10pp.

Carlson, J. K. and I. Baremore. 2002b. The directed shark gillnet fishery: right whale season, 2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL. Sustainable Fisheries Division Contribution PCB-02/13. 8pp

Carlson, J. K. and I. Baremore. 2003. The directed shark gillnet fishery: catch and bycatch, 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City, FL. Sustainable Fisheries Division Contribution PCB-03/07. 8pp

Carlson, J. K., E. Cortes, and D. M. Betheaa. 2003. Life history and population dynamics of the finetooth shark (*Carcharhinus isodon*) in the northeastern Gulf of Mexico. Fisheries Bulletin 101:281-292.

COSEWIC 2004. COSEWIC assessment and status report on the porbeagle shark *Lamna Nasus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 43 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Cortes, E. 2002. Stock assessment of small coastal sharks in the U.S. Atlantic and Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL. Sustainable Fisheries Division Contribution SFD- 01/02-152. 133 pp.

Cortes E., L. Brooks, G. Scott. 2002. Stock assessment of large coastal sharks in the U.S. Atlantic and Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL. Sustainable Fisheries Division Contribution SFD-02/03-177. 222 pp.

Field, D.W., A.J. Reyer, P.V. Genovese, and B.D. Shearer. 1991. Coastal Wetlands of the United States; An Accounting of a Valuable National Resource. National Oceanic and Atmospheric Administration (NOAA). Silver Spring, MD. 59 pp.

Foster, D., J. Watson, and A. Shah. 2004. 2003 NED experiment data analysis. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Pascagoula, MS. Unpublished report.

Garrison, L. P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001 - 2002. National Oceanic and Atmospheric Administration Technical Memorandum. NMFS-SEFSC-515. 52 pp.

Garrison, L. P. and P. M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration Technical Memorandum. NMFS-SEFSC-527. 57 pp

Gulf and South Atlantic Fisheries Development Foundation, Inc. (GSAFDF). 1996. Characterization and Comparisons of the Directed Commercial Shark Fishery in the Eastern Gulf of Mexico and off North Carolina through an Observer Program. Final Report. Marine Fisheries Initiative Grant No. NA47FF0008. 74 pp.

Helfman, G.S., B.B. Collette, and D.E. Facey. 1997. The Diversity of Fishes. Blackwell Science, Inc. Malden, MA. 528 pp.

Hoey, J. and N. Moore. 1999. Captain's report: Multi-species catch characteristics for the U.S. Atlantic pelagic longline fishery. August 1999. 78 pp.

ICCAT 1997. 1996 SCRS detailed report on bluefin tuna. Col. Vol. Sci. Pap. ICCAT. 46; 301 pp.

Junior, T. V., C. M. Vooren, and R. P. Lessa. 2004. Feeding habits of four species of Istiophoridae (Pisces: Perciformes) from Northeastern Brazil. Environmental Biology of Fishes 70:293-304.

Larkin, S. L., C. M. Adams, D. J. Lee. 2000. Reported trip costs, gross revenues, and net returns for U.S. Atlantic pelagic longline vessels. Marine Fisheries Review 62(2): 49-60.

Larkin, S. L., L. A. Perruso, D. J. Lee, C. M. Adams. *In press*. An empirical investigation of the U.S. Atlantic pelagic longline fleet: Specification and estimation of a multi-species profit function with suggestions for missing data problems. Presented at North American Association of Fisheries Economists 1st Annual Meeting, April 2001. Revised October 2001 for proceedings.

Lewison, R.L., S.A. Freeman, L.B. Crowder. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecological Letters 7: 221-231.

McCandless, C., W. D. McElroy, N.E. Kohler, C. Jensen, G. Ulrich, D. Abel, C. Belcher, and T. Curtis. 2004. 2003 Report of the Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Survey. Apex Predators Program. NMFS, NEFSC, Narragansett, RI.

Minerals Management Service (MMS), US Dept. of Interior. 1992. Comprehensive Program 1992-1997. Final Environmental Impact Statement (EIS). Outer Continental Shelf EIS/EA MMS 92-0004.

Minerals Management Service (MMS), US Dept. of Interior. 1996. Outer Continental Shelf Oil & Gas Leasing Program 1997-2002. Final Environmental Impact Statement. USDOI, MMS, OCS EIS/EA, MMS 96-0043.

NMFS. 2005. Pre-Draft of the Atlantic Highly Migratory Species Fishery Management Plan. U.S. Department of Commerce, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD.

National Oceanic and Atmospheric Administration (NOAA), 1997. NOAA's Estuarine Eutrophication Survey. Volume 4: Gulf of Mexico Region. Silver Spring, MD. Office of Ocean Resources Conservation Assessment. 77 pp.

NOAA Fisheries. 1999a. Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks. U.S. Department of Commerce, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD.

NOAA Fisheries. 1999b. Amendment 1 to the Atlantic Billfish Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document.

NMFS. 2000. Regulatory Amendment 1 to the Atlantic Tunas, Swordfish and Sharks Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Management Division, Silver Spring, MD. Public Document.

NOAA Fisheries. 2000. Regulatory Adjustment 2 to the Atlantic Tunas, Swordfish, and Sharks Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Management Division, Silver Spring, MD. Public Document.

NOAA Fisheries. 2001. Stock Assessments of Loggerhead and Leatherback Sea Turtles and an Assessment of the Impact of the Pelagic Longline fishery on the Loggerhead and Leatherback Sea Turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, FL, SEFSC Contribution PRD-00/01-08.

NOAA Fisheries. 2002. Regulatory Adjustment 2 to the Atlantic Tunas, Swordfish, and Sharks Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. 175 pp.

NOAA Fisheries. 2003a. 2003 Stock assessment and fishery evaluation report for Atlantic highly migratory species. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. 264 pp.

NOAA Fisheries. 2003b. Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks. U.S. Department of Commerce, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division Silver Spring, MD.

NOAA Fisheries. 2004a. 2004 Stock assessment and fishery evaluation report for Atlantic highly migratory species. 2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. 67 pp.

NOAA Fisheries. 2004b. Endangered Species Act-Section 7 Reinitiation of Consultation on the Atlantic Pelagic Longline Fishery for Highly Migratory Species. Biological Opinion, June1, 2004. 154 pp.

NOAA Fisheries. 2004c. U.S. National Report to ICCAT, 2004. NAT-035. 42 pp.

NOAA Fisheries. 2004d. Final Supplemental Environmental Impact Statement for the Reduction of Sea Turtle Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Management Division, Silver Spring, MD. Public Document.

National Research Council. 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press. Washington, DC.

National Research Council. 1994. An Assessment of Atlantic Bluefin Tuna. National Academy Press. Washington, D.C., 144 pp.

Porter, R. M., M. Wendt, M. D. Travis, I. Strand. 2001. Cost-earnings study of the Atlantic-based U.S. pelagic longline fleet. Pelagic Fisheries Research Program. SOEST 01-02; JIMAR contribution 01-337. 102 pp.

Romine, J.G., J.A. Musick, and G.H. Burgess. 2001. An analysis of the status and ecology of the dusky shark, *Carcharhinus obscurus*, in the western North Atlantic. Virginia Institute of Marine Science, College of William and Mary.

Rosas-Alayola, J., A. Hernandez-Herrera, F. Galvan-Magana, L. A. Abitia-Cardenas, A. F. Muhila-Melo. Diet composition of sailfish (Istiophorus platypterus) from the southern Gulf of California, Mexico. Fisheries Research. 57:185.195.

SAFMC. 1990. Amendment I to the fishery management plan for Atlantic swordfish, Charleston, SC, October 1990. 101 pp.

SCRS. 1997. Report of the Standing Committee on Research and Statistics, ICCAT SCRS.

SCRS. 1998. Report of the Standing Committee on Research and Statistics, ICCAT SCRS.

SCRS. 2002. Report of the Standing Committee on Research and Statistics, ICCAT Standing Committee on Research and Statistics, September 30 - October 4, 2002.

SCRS. 2003. Report of the Standing Committee on Research and Statistics, ICCAT Standing Committee on Research and Statistics, October 6 - October 10, 2003.

SCRS. 2004. Report of the 2004 Inter-Sessional Meeting of the ICCAT Sub-Committee On By-Catches: Shark Stock Assessment. June 14-18, Tokyo, Japan. SCRS/2004/014.

Ward, J. and E. Hanson. 1999. The regulatory flexibility act and HMS management data needs. Presentation at the American Fisheries Society Annual Meeting. Charlotte, North Carolina.

Watson, J.W., D.G. Foster, S. Epperly, and A. Shah. 2003. Experiments in the western Atlantic northeast distant waters to evaluate sea turtle mitigation measures in the pelagic longline fishery. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Pascagoula, MS. Unpublished report.

Watson, J.W., D.G. Foster, S. Epperly, A. Shah. 2004. Experiments in the western Atlantic northeast distant waters to evaluate sea turtle mitigation measures in the pelagic longline fishery: Report on experiments conducted in 2001- 2003. February 4, 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Pascagoula, MS. 123 pp.

Yeung, C. 2001. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1999 - 2000. NOAA Technical Memorandum NOAA Fisheries-SEFSC-467. 43 pp.